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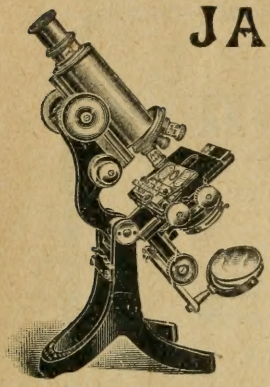

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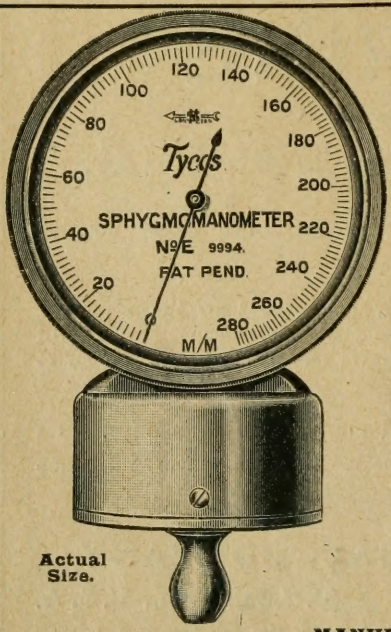

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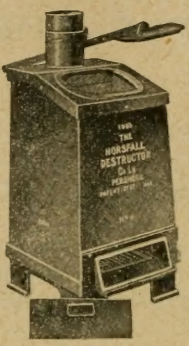

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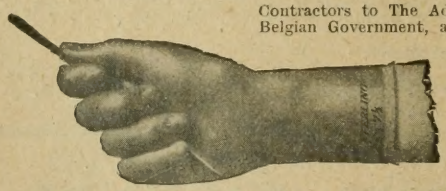

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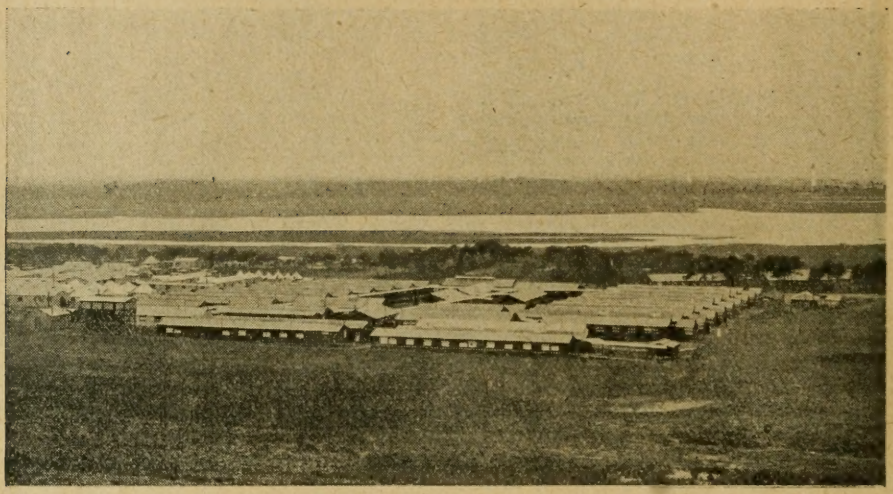

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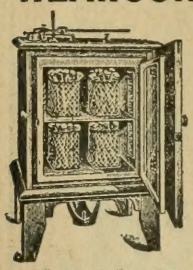

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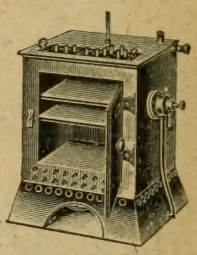

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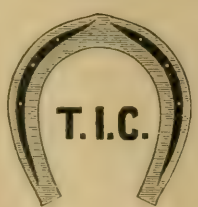

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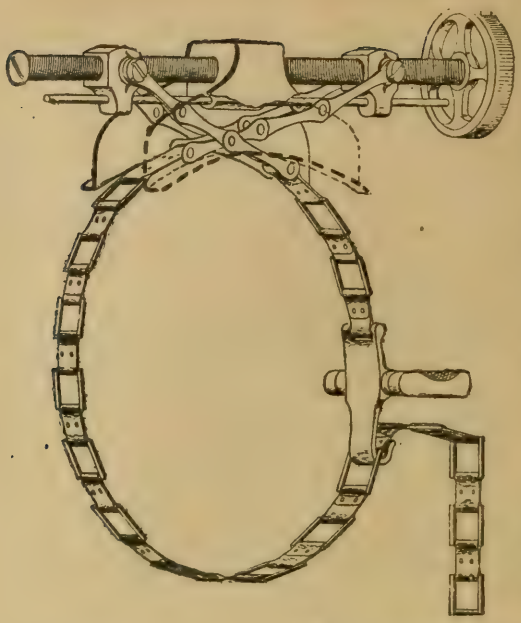

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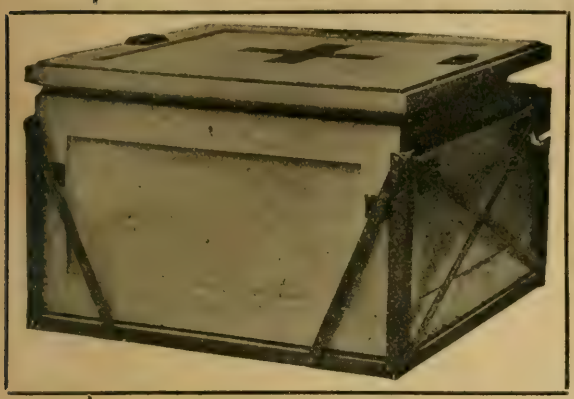

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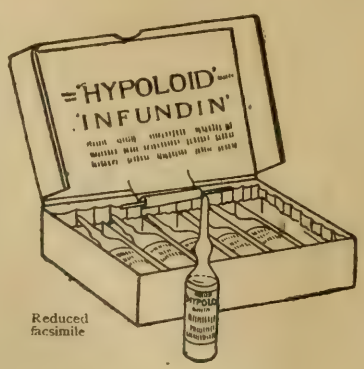

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Original Communications.

REPORT ON THE RESULTS OF THE BILHARZIA MISSION IN EGYPT, 1915.

BY R. T. LEIPER, M.D., D.Sc.

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(*Continued from p.* 190, *vol. xxvii*, 1916.)

PART V.—ADULTS AND OVA.

THE morphology of the adult worms, and of the eggs recovered from cases of bilharziosis in Egypt, has been dealt with exhaustively by several previous writers, notably by Bilharz, Leuckart, Fritsch, Lortet and Vailleton, and particularly by Looss.

VARIATIONS. In parasites generally there are certain small variations within the limits of a species both in size, shape, etc., of adults and of eggs. In *Bilharzia hæmatobia* unusually striking and constantly recurring departures from the normal have been described. In Looss' monograph on the adult anatomy it is recognized that a number of these do actually occur, but others are, in his opinion, due to errors in interpretation by previous workers. These abnormalities, rather than the normal anatomy, are our more immediate concern. The differences that have been recorded in the shape of the eggs are of special interest. As early as 1851 Bilharz had noticed that certain of these, passed in the fæces, were distorted, the small terminal spine of the typical egg being apparently displaced laterally. These lateral-spined eggs he regarded as abnormalities.

DUALITY THEORY. In 1864 Harley [214][1] was so struck by the absence of these atypical forms in cases of bilharziosis seen in South Africa, that he named the South African parasite *Distoma*

[1] These numbers refer to titles in the Bibliography of Bilharziosis which accompanied the earlier sections of this Report.

capense, to distinguish it from the Egyptian parasite which gave rise to both types of eggs. The subject remained one of merely academic interest until 1902, when Sir Patrick Manson saw in London a case of intestinal bilharziosis, contracted in the West Indies, in which lateral-spined eggs only were present. In the following year he put forward the suggestion that: "Possibly there are two species of Bilharzia, one with lateral-spined ova, depositing its eggs in the rectum only, the other haunting bladder or rectum indifferently" [328]. This view was revitalized by Sambon in a series of papers, commencing with one in 1907, in which he formally named the new species after Sir Patrick Manson, "in appreciation of this, one of his many genial intuitions" [425, 426, 427, 428]. Sambon's new species met with an unsympathetic reception, more especially from Looss, who held, with many elaborate arguments, and with some apparent success, that vesical and intestinal lesions in bilharzial infections in Egypt were caused solely by the one species, *B. hæmatobia*. The whole controversy cannot be reviewed here, but the curious reader will find in the prolonged debate "a stimulating vituperativeness" which makes it highly entertaining, if somewhat cruel reading.

Sambon's Species.

In his "Remarks on *Schistosomum mansoni*," Sambon [425] explained that his "determination is based principally on the characters of the eggs," but that in addition, he had "taken into consideration their different geographical distribution, the different anatomical habitat, and the different pathogeny of the two species." He maintained that "the lateral-spined ova are not found occasionally only, within the distributional areas of *S. hæmatobium*, as would necessarily be the case if they were the product of this species, but have a peculiar and wide geographical distribution of their own, being absent in many places where endemic hæmaturia and its causative agent are prevalent (Cyprus, South Africa)."

Looss' Theory.

The opposing theory put forward by Looss was, briefly, that "unfertilized females are not capable of producing other than abnormal eggs." These abnormal eggs were for the most part the lateral-spined variety, and where they contained a miracidium this was attributed to parthenogenesis. Looss' position, which met with clever criticism from Sambon, became somewhat changed later in the light of his own further observations, but his main tenets remained, and his final ground became, theoretically, unassailable without the aid of experimental evidence.

Looss' Arguments.

In Looss' opinion "the strange and striking differences presented by the clinical and pathological pictures of bilharziosis as seen in various places" could be explained "on the presumptive life history of the parasite, in connexion with the habits of the host and the conditions of the country" [295].

Commencing with his postulate that infection is direct and takes place at all times through the skin, he maintained that the miracidia proceed to the

liver, where they develop into sporocysts, from which worms escape later into the portal veins. As at post-mortems it is not uncommon to find males, obviously of the same size and age, alone in the portal vein, he assumed that "they must have been generated at about the same time; this would become comprehensible on the assumption that they were generated in one sporocyst." The female worms which are less common likewise would originate from a sporocyst. Applying these postulates to the ordinary conditions found in the Delta, it appeared to Looss that "several miracidia penetrate the body at short intervals and thus males and females will be present." "In this case the females will not have long to wait for fertilization." While waiting they will have produced a few abnormal eggs but being almost immediately captured by the males are carried off to the pelvic organs, with the result that "there is urinary bilharziosis characterized by the apparition of terminal-spined eggs in the urine; the same eggs may appear in the fæces, but the lateral-spined ones will be so scarce that they seem to be altogether absent" [295].

In countries where conditions are unfavourable for infection, i.e., where the population is scattered and the people do not bathe in crowds, or where water is scanty or swiftly running, and the chances of miracidia entering the skin are small, then the following train of events may be presumed: "On a single occasion a few miracidia manage to enter the skin and one gets safely to the liver. It produces males. The worms grow to sexual maturity, but finding no females they wait for a certain time and then undertake the journey to the pelvic organs alone. The liver is again free from worms: the infection remains without consequences." This may recur as male producing miracidia are so common. Eventually a miracidium enters alone which gives rise to female worms. In due time these "begin to lay lateral-spined eggs. The oviposition goes on, perhaps, for a long time. The number of lateral-spined eggs increases steadily; all are carried to the liver." Some of these worms may migrate successfully as far as the large bowel.

Eventually there will be a "strong infection of the liver and some isolated patches in the wall of the intestine, but no terminal-spined ova will ever appear, nor will there be a regular infection of the bladder. After some time, the lateral-spined eggs of the liver begin to appear in the fæces, and they continue being voided in this way for several years."

Looss details other circumstances under which a secondary infection with terminal-spined eggs may be contracted by a case showing originally Manson's intestinal bilharziosis if a sufficient interval has lapsed between the entry of the two miracidia. Lastly, infection by a large number of miracidia at a single exposure would result in a pure case of "urinary bilharziosis" [295].

Looss concludes that, from his point of view, "no sharp line of demarcation between the two types" exists. "They are simply the opposite ends of a continuous series of intermediary stages" [295].

Looss' Criticism of Sambon's Species.

After detailed criticism of Sambon's arguments, Looss dismisses them with the conclusion that "in all the evidence there is not the slightest detail which would really point to the existence of a distinct species in the West Indies and certain parts of Africa." He adds that one of the fundamental facts on which his views rest is that in 1852 Bilharz actually found in Egypt that "the eggs of *S. hæmatobium* and *S. mansoni* may occur in one and the same individual."

Sambon's Reply.

Replying in 1909, Sambon [428] pertinently points out that Bilharz's alleged observation has never been confirmed and that the interpretation that both lateral-spined and terminal-spined eggs were actually seen in the same individual worm does not necessarily follow from Bilharz's statement. In turn he attacks Looss' hypothesis, especially his assumption of the occurrence of parthenogenesis in the adults.

Looss' Readjustment.

The effectiveness of this criticism is revealed by the readjustment of his position by Looss in 1911 [298]. He now recognized that "the question of the formation of these eggs and the question of their fertilization are in reality independent." He is still of opinion that the uncopulated females are incapable of giving their eggs the normal shape. After fertilization the change to normal shape will not take place immediately; there will always be a transition period. There is thus no longer any necessity of admitting on the part of the egg cell a capability of developing by parthenogenesis." "I have received the impression that when once the production of normal eggs begins, the others are, as a rule, quickly evacuated." "That the females of *S. hæmatobium* can, and do, produce the two forms of eggs is beyond question even now."

Via Media.

American parasitologists attempted to settle the controversy by suggesting that possibly the eggs of *S. mansoni* were normal eggs similar to the abnormal forms, with distorted spine, produced by *S. hæmatobium* [271].

Bearings on Present Inquiry.

Obviously the possibility that, in Egypt, man harboured two distinct species of bilharzia worm complicated the transmission problem, already rendered intricate by the presence there of bovine and avian infections.

It was realized, however, that the full solution was not an essential preliminary to the conduct of experiments which were more urgently needed to provide the necessary data on which to base prophylactic measures for the protection of the troops. The *Bilharzia cercariæ* found in *Bullinus* and in *Planorbis*, as well as other cercariæ, were found to react in practically identical manner to changes in their environment; whether these were physical, such as exposure to heat, drying, etc., or chemical, such as exposure to dilute amounts of sodium bisulphate, etc. The *B. cercariæ* showed the same limited capacity to survive in water and

caused local irritation due to penetration of the skin in animals exposed to infection by immersion. Thus the earlier parts of this report were written with reference to "bilharzia," without touching (save inadvertently by the use of "*B. hæmatobia*" in the old inclusive sense) on the problem of the unity or duality of the parasite concerned in the causation of bilharziosis. Indeed, the success of these experiments led to a further delay. The lethal effect of very dilute solutions of coal tar derivatives on the cercariæ raised the hope that if minute quantities of these substances could be got into the portal system unchanged, they might be found to destroy the bilharzia worms there. Thus, by cutting short the egg-laying period, the subsequent severity and duration of an infection might be considerably diminished.

Surgeon-General Ford was of opinion that a satisfactory method of treatment might prove of considerable service. Expert co-operation in the pharmacological aspects of the problem was obviously desirable. As soon, therefore, as it was evident that animals were being infected successfully, I decided to infect as many animals as were then available and to return to England to carry on further work on these lines. Infections were accordingly made from *P. boissyi* and from *Bullinus*. It was hoped that these would provide material still needed for the zoological inquiries not yet completed. A return in the autumn was foreshadowed, if facilities were obtainable, in the event of the need arising for further investigations through failure of the material or the upcrop of new problems.

EXPERIMENTAL TREATMENT NEGATIVE.

Most of the infected animals survived the homeward journey. Dr. H. H. Dale, F.R.S., kindly carried out a series of tests and the animals were afterwards dissected. It was agreed that none of the substances of known anthelmintic or cercariacidal value could be introduced into the portal system in doses lethal to adult parasites. This cleared the ground for a continuation of study of the specific nature of the cercariæ found respectively in *Bullinus* and *Planorbis*.

THE CERCARIÆ IN *Planorbis* AND *Bullinus*.

In addition to the cercaria provisionally identified as that of an avian bilharzia worm, three bilharzia cercariæ were provisionally differentiated from material collected at El Marg (figs. 45, 46, 47, Part III). Of these, one (fig. 45) infested *P. boissyi;* with it, later, but seen much less frequently, was a large form (fig. 46). This mollusc was not found in some other villages where bilharziosis was also prevalent. It was, therefore, apparent that even if eventually it was proved to be a carrier of infection to man, other species of mollusca must also be concerned. The search was therefore continued, and several weeks later, at the commencement of June, examples of the genus *Bullinus* was found to be likewise infested with *Bilharzia cercariæ* of slightly different appearance (fig. 47). As cercariæ, naturally discharged, became available from each source, animals were submitted to infection by immersion, and later by the mouth.

The animals first submitted to infection died from blockage of vessels by the growing worms before these had attained their full size. Such hyperinfection was at first courted to establish the fact that the animals in experimental use were actually susceptible. Later this had to be avoided to ensure that the infected animals would survive sufficiently long to show the effect of drug treatment on the worms in the portal system, and to give the growing worms sufficient time to attain sexual maturity and produce eggs whereby the specific character of the infection could be finally identified. This proved a much more difficult task. Too slight an immersion might result in a failure to infect or a failure to infect with enough to ensure the presence of females as well as males. Mishaps from all these causes befell in the animals taken to England, and as will be seen, necessitated a return to Egypt for further material.

Early Appearance of lateral-spined Eggs.

Before leaving for London, two or three eggs only were seen. The first occurred in a female taken from the mesentery of a mouse that had survived until June 24. The others were seen a few days prior to sailing. These eggs were lateral-spined and were the result of infection with cercariæ from *P. boissyi*. According to Looss' theory these were the early abnormal products of young sexually mature females of *B. hæmatobia*; according to Sambon they should be regarded as characteristic ova of *B. mansoni*, the cause of intestinal bilharziosis; according to American parasitologists, they were merely early abnormal products of *B. hæmatobia*, simulating the true lateral-spined egg of *B. mansoni*, the cause of bilharziosis in the New World. Males were present as well as females, but this fact had now no significance, since Looss had himself abandoned the view that the females produced eggs parthenogenetically. The females found had only reached the egg-laying state. It was possible that they were just entering Looss' "transition period."

Sufficient time had not elapsed since the submission of animals to infection from *Bullinus* to warrant an examination of these prior to sailing.

After reaching London, in July, animals continued, as before, to die from hyperinfection with young adults. At the beginning of August, four monkeys which it had been hoped would survive several months, began to pass eggs and died within a fortnight of intense infection. These eggs were lateral-spined. The cercariæ used had been obtained from *P. boissyi*. No other type of egg was found. It could not be said, however, that the worms had become mature sufficiently long to have passed through Looss' "transition period."

Later Results.

Certain of the rats which had survived until September showed at post-mortem an extraordinary condition of the liver. This was enlarged and deeply pigmented with black amorphous granules. The surface was speckled with minute white spots. These were found to contain accumulations of lateral-spined eggs. The final peripheral veins were frequented by paired adult worms. The liver

from these cases was macerated and the eggs released in enormous numbers. Every described variation in size and shape of lateral-spined egg was then found, but no terminal-spined eggs were seen. These animals had been infected from *P. boissyi*.

It had proved impossible to obtain material of the occasional large cercaria in *P. boissyi* for experimental purposes, but it was anticipated that in the very large series of infections made with cercariæ from *P. boissyi* for the experiments with drugs this cercaria would give evidence of its presence. Neither in the eggs nor adults resulting, however, was any indication seen of another species. The nature of this large cercaria remained, therefore, a perplexing mystery.

Failure of First *Bullinus* Experiments.

During September the animals submitted to very slight infection were still alive and were anxiously watched for evidence of successful infection. No eggs were passed, and as the length of time that had now elapsed since immersion was considered sufficient to allow of the worms attaining sexual maturity, those treated with cercariæ from *Bullinus* were killed and examined. The results were disappointing. It was evident that in the attempt to infect so slightly as to ensure the survival of the animals for some months the number of cercariæ that had actually entered had not been sufficient to ensure successful infection with paired adults. This experiment was repeated with certain of the animals slightly infected with cercariæ from *P. boissyi*. No adult worms were found.

New Experiments in Egypt Successful.

Reviewing the position early in October, I realized that the materials now available were insufficient to enable me to deal effectively with the question of the zoological relationship of the bilharzia worms that caused the symptoms of vesical and intestinal bilharziosis. Certain facts might justify a reopening of the Sambon-Looss controversy, which had reached a position of stalemate, but they would not render the final position taken by Looss untenable. With the *B. cercariæ* available, it was clear that a complete solution was possible. The completion of this report was, therefore, postponed. I was granted permission to return to Egypt, and was enabled to do so by the Committee of the London School of Tropical Medicine, which allowed me to resume an unexpired portion of the Wandsworth Research Scholarship, which I had previously held.

Two series of experiments were seen to be required and were instigated immediately after I reached Egypt in November:—

(1) To lightly infect animals with *P. boissyi* cercariæ so that they would survive several months and thus enable the female bilharzia worms to pass the "transition period."

(2) To heavily infect animals with *Bullinus* cercariæ to ensure a successful diagnosis of the specific nature of this form. In view of the successful and heavy infections that had followed the administration of *P. boissyi* cercariæ by the mouth, it was decided to make the crucial experi-

ments by this method, which appeared to afford a more accurate means of control in the dosage. To ensure longevity monkeys were used. Additional experiments were made by immersing rats and mice in infective fluid, and other monkeys were subjected to skin infection.

These new experiments proved, after the necessary lapse of time, completely successful.

The smaller animals were killed week by week to watch the progress of the development. Worms were first recovered from a mouse, infected by immersion, on the seventeenth day. These were of course, very immature, but they showed differences in the development of the gut from those previously reared from *P. boissyi*. This difference persisted during the growth of the worms, as seen from later dissections, until the adult size was almost reached. The two lateral branches of the gut failed to unite early. In several of the experiments, males only were found. After five weeks, males and immature females were recovered from the mesenteric vessels of mice infected by immersion, but the numbers were small. A mouse, injected subcutaneously with cercariæ obtained from *B. dybowski*, by dissection showed eight adults, of which none were females, when killed thirty-seven days later. In this series, worms were found after the sixth, seventh and eighth week, but the females had not yet begun to lay eggs. On the ninth week, however, the production of eggs had commenced.

Turning to the series of infections by the mouth, the following contrast is interesting : Two Indian monkeys, taken to Egypt from London for the purpose of these experiments, were given infective fluid to drink on the same day. The female monkey received fluid containing cercariæ naturally discharged by *P. boissyi ;* that administered to the male monkey contained cercariæ naturally discharged by *Bullinus*. The female monkey began to pass lateral-spined eggs in the fæces on the forty-second day, and died from bilharzial dysentery on the sixtieth day. The male monkey showed no eggs in fæces or urine on the forty-second day and was killed. Many male and female worms were found in the liver and mesenteric vessels, but no eggs were found either free or in the females.

In the worms recovered from these older infections from *Bullinus*, the lateral branches of the gut had now united, and a short cæcum was developing. The males showed a further point of difference from those found in infections by *P. boissyi*, viz., the testes were less numerous, numbering only four to five. As this number had been recorded for *S. hæmatobium*, and was found to occur normally in *B. bovis*, it was still impossible to say whether the *Bullinus* infection was due to the bovine or the human parasite, without the evidence provided by the eggs. A further monkey had meanwhile been infected from *Bullinus* by the mouth. This passed numerous eggs in the twelfth week, and died of intense intestinal bilharziosis five weeks later. No eggs were found in the urine nor were any found in scrapings of the bladder wall. The eggs were terminal-spined without exception and corresponded to those found in man, not those in

cattle. Female worms found post mortem contained the eggs in numbers. This result confirmed the earlier find in mice which had been infected by immersion. Other animals gave confirmatory evidence. We had now established experimentally that the cercaria derived from *P. boissyi* gave rise to lateral-spined eggs, whilst those derived from *Bullinus* gave rise solely to terminal-spined eggs. In both cases infection was restricted to the intestine, but this was probably due to differences in the venous connexions of the bladder. Undoubtedly the gut wall was the primitive habitat of all the bilharzia worms.

The young but sexually mature *B. hæmatobia*, derived from *Bullinus* infection, were well able to lay terminal-spined eggs. Although the very earliest efforts did not conform completely in full size and shape to the standard egg, no evidence of a tendency to the formation of eggs with laterally-distorted spine was forthcoming.

To completely clinch the matter, a final experiment seemed desirable. Animals—monkeys and rats—were infected very lightly with *P. boissyi cercariæ* and kept alive for nine months. The living female worms, found post mortem at the end of that period were still producing lateral-spined eggs; one or two only at a time. For these coupled worms, the "transition period" must surely have long since passed.

The terminal-spined and lateral-spined eggs found in bilharzial infections are, therefore, the normal and characteristic products of two distinct species, *B. hæmatobia* and *B. mansoni*, and are spread by different intermediary hosts. The young females in each species produce slightly atypical eggs, but these slight variations do *not* "form a continuous series of intermediary stages between the two types."

As transmitter of the parasite of urinary bilharziosis in Egypt, *Bullinus* fulfils all requirements as far as distribution is concerned. It is found in the larger canals, in the smaller irrigation channels and finally, in the village ponds or "birkets." *B. hæmatobia cercariæ* have been found in the species *B. contortus*, *B. dybowski*, and once in a specimen which was recognized as *B. innesi*. These species would appear to correspond to the forms named *Physa alexandrina* by earlier workers.

The more restricted distribution of *Planorbis boissyi* would appear to correspond equally satisfactorily with the less universal occurrence of intestinal bilharziosis due to *B. mansoni* in Egypt. In the course of this inquiry, it was not found in the large canals or in the village "birkets." It appeared to frequent the smaller irrigation channels and drains where these were permanent. It was found also in marshes. Both carriers were found susceptible to drying, *Bullinus* extremely so.

The intermediate host of *B. bovis* remains to be discovered. This parasite was first found by Sonsino at Zagazig, some miles north of El Marg. Several animals were seen infected at the Cairo abattoir, but the majority of these came from the south. The veterinary inspector in charge informed us that *B. bovis* was much more common in Sudanese than in Egyptian cattle.

It may be that the large cercaria occasionally seen in *P. boissyi* at Marg is the infective stage, but of this there is no evidence save that no other Egyptian mammal is known to harbour Bilharzia.

At first it had occurred to me that these differences in size might be accounted for by the separation of the sexes in the bilharzia worms in contrast to the normal state of hermaphroditism prevailing among the Trematodes.

In his postulates Looss had argued in favour of sporocysts giving rise to adults of one sex only, to explain the frequent presence of males only in an infected person. This highly suggestive hypothesis may well prove true for the sporocysts and their resulting cercariæ in the molluscan host.

Experience shows that if the cercariæ discharged from one specimen only be used for experiment, the resulting worms may be of one sex only. Owing to the extreme fragility it was impossible to isolate a single "tube" of cercariæ from an infected liver and so put the matter to experimental proof. Experimentally infected animals, like naturally infected persons, usually show a marked predominance of male over female worms. This would seem to be a happy provision of nature to ensure that no female that had successfully gained her way into the final host should lack opportunity of producing offspring.

Other Problems.

There is one other matter relating to the bilharzia problem as presented by the village Marg which was for a long time puzzling, but for which a tentative explanation may be suggested. Urinary bilharziosis prevailed among the children in Marg to the extent of ninety per cent. The incidence of intestinal and particularly Manson's intestinal bilharziosis could not conveniently be ascertained. The presence there of infection with lateral-spined eggs was revealed by the find of specimens in the urine of one of the infected children. Now in the small canal within the confines of the village, *P. boissyi* was relatively more frequently infected with cercariæ, i.e., with *B. mansoni* than was *Bullinus* with *B. hæmatobia*. After many visits the habits of the residents became fairly well known. The shelving banks of the canal served as a public latrine. The sides and uncovered bed of the channel were strewn with fæcal deposits. The Egyptian squatting for the purpose of defæcation faces the bank to observe anyone approaching. Consequently, any urine discharged falls on to the dry surface at a higher level than that at which the stool is deposited. This urine sinks into the dry soil leaving bilharzia eggs on or near the surface where they are exposed to the destructive effect of sun and wind. The eggs passed in the fæces are not so readily killed. It is well known that bilharzia eggs will remain alive and unhatched, in a fairly consistent stool, for weeks under suitable conditions. At Marg the level of the water in the canal rises and falls with a varying periodicity owing to the control in the amount of flow by the irrigation department. The consequence is that the sides of the canal, and especially the flatter portions of the bed, are automatically and

periodically washed. The bulk of the lateral-spined eggs will be set free and will rapidly hatch in the immediate vicinity of the proper intermediary *P. boissyi*. The terminal-spined eggs which hatch are only those that have been passed in the fæces, and to this limited extent the *Bullinus* snails will become infected. Within the village the stream is too shallow for bathing. In the summer the children proceed higher upstream and to the parent canal where *Bullinus* is unaccompanied by *P. boissyi*. It does not necessarily follow, therefore, that the incidence of bilharzial dysentery and hæmaturia due to *B. mansoni* and *B. hæmatobia* respectively should correspond to the incidence of infection in the respective intermediary hosts within the village. Unfiltered water for all uses is taken from this stream into every house in Marg, so that the chances of infection within the home seem very great, both from the use of the water for drinking and for washing. Practically nothing appears to be known of the prevalence of intestinal bilharziosis, especially among women.

BILHARZ'S "FUNDAMENTAL" OBSERVATION: SUGGESTED EXPLANATION.

Before leaving the Sambon-Looss controversy, I have necessarily to deal with Bilharz's original observation [27], as Looss regarded this find of lateral-spined and terminal-spined eggs in the same female as one of the fundamental facts on which his own view rested.

When first seen by Bilharz the lateral-spined egg was an enigmatical body. It was first thought to be possibly a kind of pupa; only later did Bilharz conclude that it was definitely egg. Bilharz's find of this peculiar body within the female is recorded, as translated by Looss, thus: "such a body was, though once only, but quite undoubtedly, found in the uterus of a female worm, the posterior part of which contained the normal ova."

Sambon contends that Bilharz did not here actually refer to a lateral-spined egg, but to a pigmented body and that "he only says that a peculiar brownish yellow body, furnished with a lateral spine was found only once within the oviduct of a female worm, the posterior part of which contained the ordinary ova." There is no clear indication, according to Sambon, that the ordinary ova were terminal-spined ova or that the point of his remarks had reference to the position of the spine, rather than to the dark yellowish discoloration.

To this objection Looss replies later by quoting a further statement by Bilharz: "Strange to say, the eggs appear under two different forms. The two forms were found within the oviduct of the mother as well as in the tissues of various abdominal organs of man."

The latter quotation to my mind brings no support to the contention that Bilharz found the two types within the same individual worm. Here he apparently wishes to convey that the shape of the egg was already determined before the egg left the female and was not a result of distortion in passage through the tissues—a view that has been held later by others.

On the other hand, having read carefully the original text, I am fully

convinced by its context that Bilharz really believed that he had seen the two types in the female, when he wrote the first statement, and that the shape of the egg, not its colour, was what he wished to bring under notice. Earlier in the same paper he describes the normal ova as terminal-spined.

An even more important paragraph in this paper has not been utilized by Dr. Sambon. Bilharz states that this body occurred in one of the first females that he examined. A drawing was made at the time, but no importance was then attached to the observation. A similar condition had not been met with again. Now it seems legitimate to infer that an observation made at the commencement of the research might not have the accuracy or detail of later results when more material was available. The

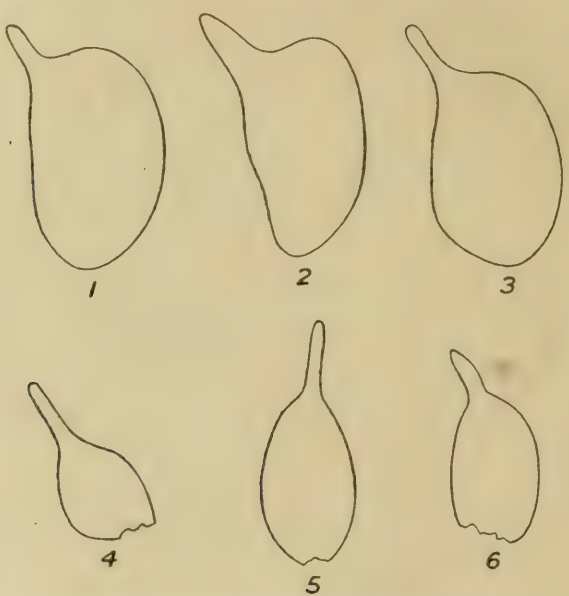


FIG. 1.—A series of eggs (1 to 6) found within the uterus of the same female Bilharzia. (*Journal of Tropical Medicine and Hygiene*, 1911, p. 120.)

eggs with lateral spine are very striking objects, even when seen through the body of the females, but the ordinary ova observed by Bilharz may have been only apparently terminal-spined. My own suggestion is that Bilharz met with one of those females seen occasionally in which egg-laying has only just commenced. I have figured a series of eggs from one such female in the *Journal of Tropical Medicine* for 1911 [271]. The outlines are reproduced here. The first-formed egg (1) is lateral-spined, and lay just within the vulvar opening. The others (2 to 6) lay one behind the other towards the ootype, (6) having just passed from the ootype. All the eggs were rolled to show the greatest amount of lateral displacement of the spine. The later samples, it will be noticed, were incomplete and did not contain an ovum. These were, in fact, casts of the ootype in egg-shell

without normal content. If Bilharz met with a female similar to this one at the commencement of his investigations, he might well have concluded that the worm contained both types of egg.

When these sketches were made, I thought they might give support to the view put forward by Ward that the terminal-spined type of worm produced at first abnormal eggs with a sort of lateral spine; not identical with the lateral-spined egg of the New World.

On this interpretation the female was actually in Looss' "transition period," but the formation of standard terminal-spined eggs had not been reached. I now believe that the female was one just commencing to lay; that ovulation had not fully set in; and that after producing one or two complete eggs a number of casts of the ootype in egg-shell were thrown off. I have since met with similar abnormal lateral-spined eggs in the material obtained by maceration of the liver of animals experimentally infected with *S. mansoni* in Egypt.

Other Modes of Infection.

Among South African tribes there is a widespread belief that the cause of hæmaturia there, which we know to be bilharzia, enters the body through the orifice of the penis during bathing.

To prevent this certain races, such as Zulus, wear a basket-like protection. Pfister [323] has shown that a similar belief and a like form of protection prevailed among the ancient Egyptians. Its mode of use is to this day figured on the walls of some of the ancient temples of Egypt.

The belief, so far as I am aware, is no longer current among the native populace in Egypt. It has however spread in South Africa among the white population although the protective measures do not seem to be in vogue with them. The matter is of interest here because, as I am told, troops proceeding to Egypt were instructed that they could avoid bilharzia infection while bathing in the canals there, if they took the precaution of wearing the European equivalent of this ancient speciality.

During the field work in Egypt certain observations seemed to afford a rational basis for this ancient belief. Often one found small and very agile leeches on the nets and collecting gear. These were indeed a great pest for unless they were carefully excluded from the aquaria they rapidly destroyed the molluscs. Now I have heard of one or two cases where such a small leech entered the penis during bathing, and, lodging in the urethra, gave rise to profuse bleeding. This I believe is the probable origin of the association of a penile ingress with bilharzial hæmaturia and in so far as these penile sheaths have proved efficacious this is probably due to the exclusion of leeches.

In this report it has been shown that infection through the mouth is readily induced experimentally. As the acidity of the stomach destroys the cercariæ, it has since been argued that such experiments are of little practical significance, giving merely an extension of the area of skin infection. I am personally inclined to attach much more importance to this

demonstration of mucous membrane invasion ; more especially as it brings me into line with the conclusions of Day. This distinguished observer came to the conclusion from a close study of the conditions of infection in Egypt that the nasal and oral ablutions, carried out as a part of religious ceremony, played no small part in the repeated infections with bilharzia seen in the Egyptians, more especially of male sex. One of the most heavily infected sites in Marg was at the water's edge immediately in front of the local praying ground upstream of the village.

Extent of Risk to Troops.

From the established facts regarding the mode of spread and of infection it is evident that troops deriving their water supply for all purposes from the large public water-works run no risk of infection, even though the washing places become accidentally contaminated with urine containing bilharzia eggs. The risks were among those stationed in small parties on the various bridges, roads and canal crossings throughout the Delta and among the troops occupying new camps on the freshwater canal, in the Fayum and elsewhere. Although supplied with pure water for drinking purposes, this had often necessarily to be supplemented by local supplies for general purposes. At one such place it was pointed out to me that the daily ration of water could be supplemented with ease "from a wee bit burn" which seemed to be of clear good water. A brief examination showed however that there were many *Bullinus* in this stream, which was simply an irrigation channel derived from a main canal on which was a large native population a mile or two inland.

Asked on one occasion what I thought were the risks from uncontrolled access to canals in the neighbourhood of camps during the summer I put down a conservative estimate of ten per cent. It is therefore of interest, and indicative of the value of the propaganda and prophylactic measures afterwards undertaken, that in two squadrons stationed at one of these camps during the summer of 1915 no less than twenty-seven, i.e., about twelve per cent strength contracted bilharziosis.

With the information at the disposal of the troops bilharziosis should now be treated as one of those diseases for which the individual is mainly, if not entirely, personally responsible.

Morphological Differences between the two Egyptian Species.

After the publication of *B. mansoni* as a distinct species in 1911, several American workers made a study of the anatomy of adult worms collected in the West Indies, Panama and Brazil, in search for morphological characters by which the species with lateral-spined egg could be distinguished from the terminal-spined form found in the Old World.

Comparing their finds with the formal descriptions given by Looss and others, they noted and briefly described the following peculiarities.

Holcomb [233] found that the adults of *B. mansoni* had a brown colour and a somewhat larger ventral sucker. Piraja da Silva [444] was struck by

the unusual appearance of the anterior end of the male worm which differed in outline from that figured, after Looss, as characteristic of the Egyptian worm in most text-books. The female appeared to taper towards the posterior extremity instead of ending abruptly. The cæcum approached the end of the body more closely. The oviduct united immediately with the vitelline duct instead of passing forwards to fuse with it at the ootype. The spinous papillæ did not seem so salient.

Flu [172] saw differences in the manner in which the anterior edges of the lateral walls of the gynæcophoric canal joined the body in the male and in the female in the presence of a coiled ovary in full grown specimens.

A further point of apparent differential importance was noted by myself in 1908 as a result of an examination of a batch of male bilharzia worms, collected at post-mortem by the late Dr. Turner, from cases of mixed infections in natives of Portuguese East Africa and Nyasaland. I quote the following interesting portion from my half-yearly report to the Colonial Office in May, 1908. "In cases of mixed infections (as ascertained by microscopical examination of bladder and rectal walls) I have been able to separate into two groups males having four somewhat angular large testes and males having seven to nine small spherical testes. In other cases all the males obtained belonged to one type. The difference in character and especially in number of testes would be considered as a specific character of some reliability if occurring in other groups and if constant as it seems to be here. In order that this character can be utilized in support of the view that the two forms of bilharziosis, rectal and urinary, are caused by parasites specifically distinct, it remains to be shown that males having one particular type of testes are usually or always in sexual conjunction with females producing one type of egg.

"Granted for the moment that these types of testes and of egg be found to occur constantly, the probabilities are that the male with four testes is the mate of the female giving rise to terminal-spined egg; for this is the normal arrangement of testes figured by Looss and the terminal-spined ovum is the one recognized by him as the normal product of the mate of this form.

"In support of this view, I am able at present to offer only one actual observation, in itself a striking one, owing to the lack of females in my material. In the one specimen of a paired couple in my possession, the testes can easily be made out to be seven. The female lies in the gynæcophoric canal, but its posterior half is broken off. Lying also in the canal, however, is a small 'clot' containing several lateral-spined ova. We have, then, evidence of the association of the multitesticular male with the female having lateral-spined eggs."

Replying to the points of difference as set out by Piraja da Silva, Flu, etc., Looss [300] maintained that these features were to be seen equally in specimens of *B. hæmatobia* in Egypt, and that they might be explained at least in part by varying degrees of contraction in the preserved worms.

As the chief monographs on the anatomy of the adult bilharzia worms were based on materials collected in Egypt, such material quite probably came from mixed infections. A comparison of the anatomy of adults of *B. mansoni* from uncomplicated cases in the New World with these published descriptions of *B. hæmatobia* was not likely to lead to acceptable conclusions.

It is evident then that a final settlement of the specific differences between the adult worms of *B. hæmatobia* and *B. mansoni* must be based upon a comparison of specimens taken from cases of unmixed infection and preferably from cases in South Africa and the West Indies respectively, where such infections occur.

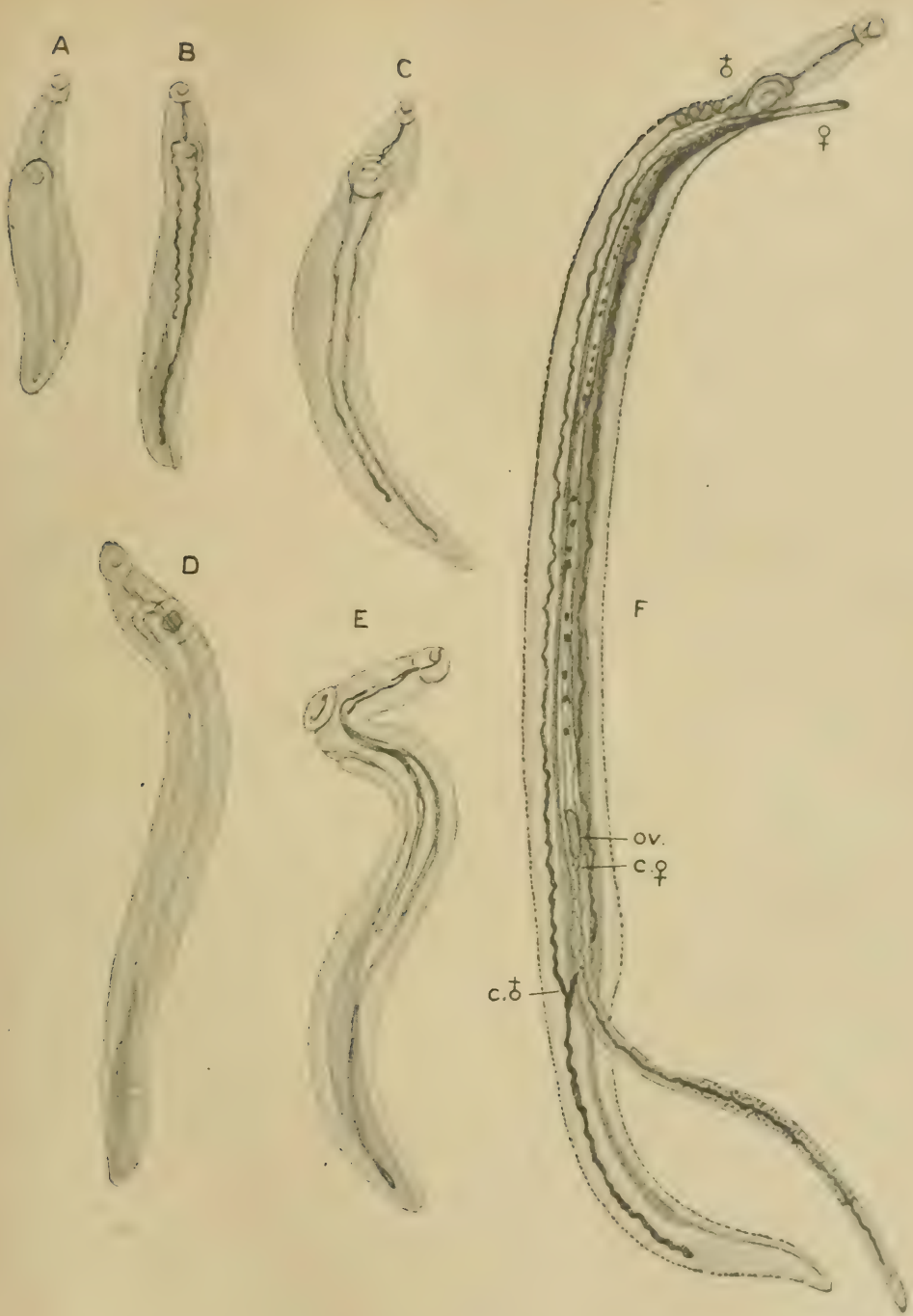
The bilharzia worms that have been reared experimentally from *Bullinus* and *Planorbis*, unfortunately, do not attain in the laboratory animals the full growth met with in their natural hosts. Although sexually mature and actually producing eggs, the worms are still young and small. Differential characters based upon measurements are likely to be fallacious under these circumstances. Morphological differences, may, however, be relied on; especially where these can be verified by reference to full grown adults taken from the human body in unmixed cases of vesical and intestinal bilharziosis. Unfortunately, an opportunity of obtaining such material has not been forthcoming hitherto. The following account of the differential characters as seen in experimentally reared worms must be regarded as a purely tentative attempt to differentiate the two species. It will be noticed, however, that it gains some extraneous support in the observations on the anatomy of *B. mansoni* quoted above.

In the males reared from *Bullinus*, the testes appear to number four or five almost constantly. They are also of fairly large size.

In males reared from *Planorbis*, the testes number seven to nine, and appear to be relatively small. Differences between the two sets of males are noticeable in the shape of the anterior portion bearing the suckers, and the relative size of the suckers is probably also to be regarded as of specific account.

In females reared from *Bullinus*, the eggs are constantly terminal-spined, even in small young females. The ovary is smooth and situated near the middle of the body. The lateral branches of the gut are lengthy and the cæcum correspondingly short. With this the range of the yolk glands which surround the cæcum throughout its length is apparently short.

In females reared from *Planorbis boissyi* the eggs are constantly lateral-spined. Usually one, seldom two, and very rarely, four eggs, occur in the uterus at one time. This is due to the short length of the duct. The lateral branches of the gut unite early, and there is a very long cæcum. The yolk glands surrounding the cæcum have, therefore, a correspondingly long range. The ovary lying in the fork made by the union of the gut branches is elongated and is within a short distance of the uterine pore.



Bilharzia hæmatobia (s. str.), developed from cercariæ discharged by *Bullinus* spp.

A—E = Immature stages from liver showing delayed union of gut.
F = Adults *in copula* from mesenteric vein, showing short cæcum and corresponding changes.
ov. = Ovary.
c. = Commencement of cæcum.

The difference in the point of union of the lateral branches of the gut in the two species is common to male and female. It is a very noticeable feature in the growing worms. The posterior portion of the young worm would seem to be a growing tissue, which, by its continued lengthening, changes the relative measurements of the various parts of the gut almost until maturity is attained.

The attainment of egg-production is more rapid in *B. mansoni* than in *B. hæmatobia*. In experimental infections from *P. boissyi* eggs were found after six to eight weeks, from *Bullinus* after nine to twelve weeks, depending on the intensity of infection and on the host.

The developing worms and coupled adults reared from *Bullinus* infections are illustrated in figure on p. 251.

NOMENCLATURE.

The question of nomenclature remains now to be reconsidered in the light of the foregoing results. The generic name Bilharzia, proposed first by Cobbold [92], gained almost universal acceptance, especially in medical works and in contributions on the clinical and pathological aspects of infection. I have used the name Bilharzia in the present report, as it is the one by which the disease is commonly diagnosed. Within recent years, however, the name Schistosoma, given by Weinland [515], in 1858, has been revived under the present operation of the Laws of Nomenclature. It is the more correct, although Cobbold states that under the laws in use at the time, Weinland accepted the priority of Bilharzia over Schistosoma. If the former generic term is used, the species should read, *Bilharzia hæmatobia*, and if the latter *Schistosoma hæmatobium*. It is to be hoped that on grounds of use and suitability, the specific names of *Bilharzia hæmatobia* and *Bilharzia mansoni* may retain their present application. Doubtless some day, it will, however, be noticed that the *Distomum hæmatobium* originally named by Bilharz, was based upon mixed material, and is, therefore, a composite species. Harley, the first reviser of the species, split this *D. hæmatobium* into two components. To the species giving solely terminal-spined eggs, he gave the name *D. capense*, restricting the name *D. hæmatobium* to that form found in Egypt which produced both kinds of eggs. I foresee that the name *B. hæmatobia* may thus be reserved by purists in nomenclature to the single specimen described by Bilharz, which conforms with these requirements.

There finally remains the *Bilharzia magna* found by Cobbold in a monkey. The type and only specimen, is preserved in the Hunterian Museum. It is a fragment of a male. I have been quite unable to identify it with either of the species now recognized in man. This is a happy circumstance, for we may now without anxiety retain the specific name of *B. mansoni* (with which the whole species problem has been indissolubly connected), in its rightful place to recall for future students the insight of one who took no part in controversy, but silently worked through others less inspired, for the eradication of many of the great pests of the Tropics.

Molluscan Nomenclature.

Throughout this report the naming of the various fresh-water molluscs is based upon Pallary's monograph. It has not seemed desirable to attempt to determine to what extent the various specific names of the genus Bullinus, such as *B. contortus*, *dybowski*, *alexandrinus*, *innesi*, etc., are synonyms of one another or of the names *brocchi*, etc., used by Jickeli and older workers. The name Bullinus is itself subject to controversy. Sowerby, Fischer and others use the older spelling Bulinus, while some are inclined to adopt a more recent synonym Isidora. By keeping to that of the most recent and best illustrated paper on the subject, which, moreover, is published in Egypt, we have avoided introducing confusion for local workers who may be interested more especially in the public health side of the question.

PART VI.—BEARING OF PREVIOUS WORK ON *B. JAPONICA* AND CONCLUDING REMARKS.

Given the premises laid down by Looss as a result of prolonged study of local conditions in Egypt, his theory, "based upon a large number of anatomo-pathological and helminthological facts deliberately weighed and compared," could not be overthrown simply by an argument from analogy. If it were otherwise, those who accepted and supported his views bear a heavy responsibility for failing to apply the analogies resulting from the experimental data afforded by experiments with *B. japonica;* the first and most fundamental of which, made by Fujinami and Nakamura in 1908, excluded, for this allied species, the possibility of direct transmission.

In the opening section of this report, I have traced the evolution of scientific opinion regarding the mode of spread of *Bilharzia hæmatobia*. The analogies presented by *B. japonica* have there been referred to only to show how these were definitely set aside by the exponents of the theory of direct infection in Egypt. I have refrained from using them as an a priori argument, because in the proved facts of the life cycle of another common Egyptian parasite of man there was a strong opposing analogy, in support of the possibility of an exceptional occurrence of direct infection among parasites requiring usually an intermediate host. *Hymenolepis nana* has been shown experimentally to be capable of direct transmission although the other members of the genus have arthropod intermediaries.

Moreover, the object of my own work has been to arrive at a solution of the various problems, presented by the bilharzial diseases in Egypt, by direct observation and experiment, rather than by the inductive method.

I propose to relate now the various published facts concerning the life-history of *B. japonica* that were available at the outbreak of war; to show in what respects these failed to afford the data necessary for a rapid solution of the bilharzia problem in Egypt and in what way my own investigations on this Oriental species, while confirming previous conclusions of Japanese observers, gave a new method by which the infective

stage could be quickly and accurately delimited in the molluscs of a heavily infected locality. By its use the peculiar difficulties which have so long beset the bilharzia problem in Egypt were speedily overcome.

Before dealing with these investigations, I must recall that the problem of the bilharzia worms was not one of a peculiar and new type of larval development. It concerned rather the seat of this development and the exact route by which reinfection of man took place.

Holders of the theory of direct transmission were in agreement with their opponents that the larval metamorphosis of the bilharzia worms conformed, in all essentials, to that of other digenetic trematodes. Thus Looss, in 1908, wrote: "The existence of these (germinal) cells in the bilharzia miracidium is absolute evidence that the miracidium cannot develop directly into an adult worm, but must pass through the stage of the sporocyst which in its turn produces, either and probably at once, or by one or more intermediate generations, the definite worms."

The fundamental problems for each species of bilharzia worm were these: (1) Did the species follow its typical larval development in the liver of man or of a mollusc? (2) Did infection take place through the skin or by the mouth? (3) If a mollusc was an essential intermediary, what were the species concerned in the transmission of each species of worm? As regards the *B. japonica*, the first and second of these problems were, to my mind, conclusively settled by the researches of Fujinami and Nakamura in 1908.

In those regions in the Far East where man is infected with *B. japonica*, infections also occur naturally in cattle, cats and dogs. Using these animals therefore, as tests and controls, the following experiments were made. In the first investigation numerous miracidia were hatched in water. Dogs were then immersed in this. No results followed. In the second series, cattle, cats and dogs were submitted to possible infection by immersion in rice-fields and neighbouring ditches and streams reputed to be sources of infection. Intense infections with *B. japonica* ensued.

In 1910 other animals, not found naturally infected, were proved susceptible by experimental immersion, viz., mice, white rats, guinea-pigs, rabbits and monkeys.

In these experiments, described by Fujinami in a paper issued from the Internationale Hygiene Ausstellung in Dresden, in 1911, young parasites only 0·15 millimetre long were found in the portal system on the third day after immersion.

In 1911 Miyagawa described the invasion forms, as seen in the peripheral vessels and cutaneous tissues in two to twenty-four hours after immersion. These forms were smaller than those seen by Fujinami but differed in no essential respect. Oral and ventral suckers and a gut were already present.

In 1913 Miyairi, by experimentally infecting local molluscs with miracidia, found a sporocyst in an unidentified snail, stated to be a

Lymnæus, as Katsurada announced in a footnote to an article on "Schistosomiasis japonica," in December (*cf.* Bkt. 72, p. 378). Miyairi's original publication is in Japanese, but Kumagawa gave a summary of the chief points in an abstract published in the *Tropical Diseases Bulletin*,[1] in March, 1914.

"They noticed also that in the infested locality there are many snails in the waterways and ditches. Of these snails a great many Cercariæ parasitize one which has a dark coloured shell with seven spirals. The authors carefully picked up a number of young non-infected snails and tried whether the miracidia entered their bodies or not. They found that the miracidium enters the body of the snail, penetrating the cuticle with the lips and proceeds to the gills and the wall of the digestive canal. After twelve days the first rediæ appear and gradually concentrate to the hepatic ducts, elongating, and a number of the second rediæ are seen. The authors put mice into the vessel in which the full grown snails were fed, for three hours every day and repeated this experiment for four days. After three weeks they found a great many *Schistosoma japonicum* in the livers of the mice. The authors conclude that this kind of snail is an intermediate host of *S. japonicum*."

Judging by titles, other papers appeared in Japanese journals, but these are inaccessible. During 1914, Katsurada (according to an Italian abstract) "confirms the assertion of Miyairi and Sudzuki, but regards the question of the intermediate host of *S. japonicum* as not altogether cleared up."

It is evident that the above information, while definitely establishing a molluscan intermediary for *B. japonica* was of little value as a guide to the elucidation of the special problems surrounding the *B. hæmatobia* transmission, and gave no facts regarding the bionomics of the infective stage, or of the carrier, upon which to base prophylactic measures. In Egypt all attempts to advance by infecting with the miracidia had failed, even in Looss' skilled hands. Sonsino and others had found no means of identifying the *B. cercariæ* among the numerous developmental stages found in the snails of the endemic area in Egypt. There was not available for experimental purposes any animal of known susceptibility but man. Lastly, there still remained no explanation of the frequency of bilharziosis amongst very young children in Cairo.

In an article published in Mense's *Handbuch* in 1914, Looss admitted when dealing with *B. japonica*, that after Miyagawa's experiments the existence in this species of a free swimming cercaria was quite plausible. Under *B. hæmatobia*, however, he states that if it is correct that there is an intermediate host in the Oriental species, "then *B. japonica* must differ essentially in its development from *B. hæmatobia*." That Looss' view was still maintained by others is shown by the advice tendered to the

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[1] Full titles and abstracts of the preceding and of all available publications on *B. japonica* are to be found in the volumes of the *Tropical Diseases Bulletin*.

Army in Egypt for dealing with an outbreak of bilharziosis amongst the troops stationed at Kasr Nil Barracks during 1912. In an article in 1915 by another authority in Egypt the following occurs: "Any small puddle or hole may become defiled, and in a very short time the water or mud is alive with miracidia, which may become applied to the bare feet, arms or hands, penetrate the skin directly and so lead to infection." "Certain evidence we have none nor has any intermediate host ever been discovered."

Reviewing the bilharzia problem in the Spring of 1912, in the light of Fujinami's experiments and the repeated failures to infect monkeys and other animals with the miracidia of *B. hæmatobia*, I concluded that the time had come to renew the attempt made by earlier workers to establish a molluscan transmission for this parasite.

In view, however, of the lack of success which had attended the previous efforts of Sonsino, Lortet and Vailleton, and others to follow the miracidia, a new method of approach seemed called for.

The occurrence of *Bilharzia magna* in *Cercocebus fuliginosus* rendered it not improbable that by subjecting monkeys of this species to immersion in water containing the various cercariæ, found in the endemic area, a positive result might eventuate. As *B. hæmatobia* occupied a peculiar habitat in man and did not naturally infect any other animals a negative result might follow. In any case such an empirical method would obviously involve the purchase, transport and maintenance of a large number of monkeys or necessitate an unusually prolonged investigation, for which the necessary financial support was not likely to be forthcoming.

The experiments of Fujinami and Miyagawa appeared to me to open up a possibility that a morphological clue might be established by which the bulk of cercariæ of unknown origin could be excluded microscopically; thus bringing the experimental use of monkeys within practical limits.

Was there any outstanding feature which distinguished the adult distomes from the adult bilharzia worms and which had, in all likelihood, persisted from the sexless cercarial stage? In the cercaria there are organs, like the tail, which are purely larval structures, and others, like the suckers and the gut, which persist from the body of the cercaria through adult life. In some cercariæ, however, the gut has not yet formed although there is an oral sucker.

The suckers are, both as regards structure and position, very similar in distomes and bilharzias. The alimentary canal is, on the other hand, markedly different. The bulk of the distomes have a separate muscular pharynx. There is no pharynx in the bilharzia worms.

If this distinction were one which persisted from the cercarial stage then it afforded an easily determined morphological clue by which one could immediately exclude the vast majority of cercariæ, which are distomes.

It might be that the pharynx, originally separate, became fused with

the oral sucker in the adult as occurs in the amphistomes. Without definite evidence it was, therefore, impossible to come to a trustworthy conclusion regarding the absence of a pharynx in the cercaria of bilharzia.

Happily such evidence was now procurable as a result of the discovery of the "invasion forms" of *B. japonica* by Fujinami and Miyagawa. From the description of these bodies, which were said to possess oral and ventral suckers and a developed gut, it was evident that they were infecting cercariæ, but there was no mention, in either paper, of the presence or absence of a pharynx.

It was obviously necessary to establish this point by actual observation, not merely by inference, if it was to be utilized as a basis for experimental work.

My plan then was, in 1912, to proceed to Japan, and by repeating the original experiments or by examining the original preparations to settle this question; to confirm the expected value of the clue by examining the molluscs of the district where Fujinami has conducted his immersions and which was known to be intensely infected; and thence to proceed to Africa. If one or more of the molluscs there was found to contain cercariæ exhibiting this peculiarity, then it would be possible to attempt the experimental transmission of bilharzia to monkeys with every prospect of success.

These plans were, however, subject to other counsels and it was not until the summer of 1914 that I felt free to carry out my original scheme. This I was then enabled to do fully, thanks to the cordial co-operation of Professor Fujinami. Through him I was able to examine the "invasion forms" and to establish the value of my morphological clue by a visit to the rice fields of Katayama, where the ease with which the test could be applied to the molluscs in an endemic area was quickly demonstrated. With cercariæ exhibiting this morphological peculiarity, mice were afterwards infected successfully with *B. japonica*.

In the meantime, however, Miyairi and Sudzuki, as related above, had succeeded by another method of approach in tracing the metamorphosis in a closely allied, if not identical, snail, in the South Island of Japan. My own observations therefore confirmed generally the results of these workers, apart from establishing my chief, ulterior object; which was to provide a simple and reliable means of attacking the complex problems of *B. hæmatobia*.

In regard to details, concerning which only the abstract by Kumagawa was available, I was unable to confirm the presence of "rediæ" in the development of *B. japonica*. From my own observations I had concluded that the *B. cercariæ* originate in sporocysts. I was not in a position, pending fuller information, to decide whether these "rediæ" were actually developmental stages of bilharzia or of some other species with which the

snails, experimentally infected with miracidia, had been naturally infected previously.[1]

On my return voyage, after the outbreak of war, I visited Egypt and found that though the results of the recent work on *B. japonica* were known there, it was still held that they gave no solution to the special problems presented by the *B. hæmatobia*.

Considering that the new facts derived from my own observations on *B. japonica* would enable me to overcome the experimental difficulties which had hitherto surrounded the Egyptian question and realizing the immediate importance of some simple and efficient prophylactic measures for the large bodies of troops then proceeding to Egypt, I sought and obtained the occasion for the investigations in Egypt related in this report. A study of the accounts given by Sonsino and Looss of the cercariæ found by them in the course of their search showed that they had not seen and passed over the *B. cercariæ*. The bulk of their cercariæ possessed a distinct pharynx. In a few it was absent but in these there was merely an oral sucker without any development of œsophagus or gut. It was evident that these forms had still to undergo maturation before they could become infective to their definitive hosts and as some possessed a definite perforating spine and other peculiarities of forms that undergo encystment in fishes and other secondary hosts, these cercariæ were readily excluded. It was therefore necessary to find further cercariæ which had hitherto been overlooked. The search for this was made by the method of intensive study of a small heavily infected area. The fact that *B. japonica* developed in a genus of the family hydrobiidæ was of no assistance. Indeed by those unversed in the bionomics of helminths this might have been taken, disastrously, as an additional and invaluable analogy. In point of fact the Egyptian bilharzia worms were found to infest two genera of freshwater mollusca belonging not merely to a different family but to a different order. In other words, *B. japonica* and *B. hæmatobia* (s. lat.) were found in snails as distantly related in classification as are the lice to the mosquitoes. In

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[1] In Egypt we found commonly present in the species which were actually intermediaries for the various *Bilharzia cercariæ* additional developmental forms; some developing in rediæ and other, bifid-tailed, forms developing in sporocysts which bore a superficial resemblance to *B. cercariæ*. It is obvious from the illustrations given by Cawston that such forms were mistaken by him for *B. cercariæ*. Thus, prior infections may prove a serious source of fallacy to those endeavouring to advance experimentally from the miracidia unless the results are carefully checked by the morphological method.

In a report written on my return from China in October, 1914, I had to content myself with the statement that my results confirmed Miyairi's main conclusion, and that in the absence of any accessible publications a comparison of the detailed conclusions was for the present impossible. Apparently during the closing months of 1914 Miyairi and Sudzuki published in Japan, in German text, a detailed account of their findings. From this, which is well illustrated, it is now evident that divergence of view regarding these "rediæ" is due solely to a difference in interpreting the same structures.

its application to these new cercariæ the morphological clue fully vindicated its use. Within three months no less than four *B. cercariæ* were obtained by this method of exclusion. Two of these were selected, on epidemiological and other grounds, and with these two alone, experiments were made on *Cercocebus fuliginosus* and other animals. These forms proved to be the infective stages of the two bilharzia worms which cause bilharziosis in man in Egypt. No experiments were made with any other cercariæ.

Here I may well bring to an end a Report that has been kept open much longer than was intended, and of which the earlier sections were written while experiments were yet in progress. Much material remains which, when elucidated, should add further to our knowledge of these and allied Egyptian parasites. Its description, however, scarcely comes within the terms of the present inquiry which were "to investigate bilharzia disease in Egypt, and advise as to the preventive measures to be adopted in connexion with the troops." These objectives, I believe, have been fully achieved. A complete zoological study of the adult parasites, or of their development, has not been attempted. Such attention as has been given to their morphology and bionomics has been directed to those points concerning which an understanding was essential as a basis for prophylactic measures. The difficulties which beset the inception of the work in a strange country, with some elements critical and hostile, were quickly overcome. Sickness, however, almost wrecked the inquiry at its commencement. Within a month of our arrival Dr. Cockin had fallen sick, and was invalided home. Three weeks earlier I had been admitted to hospital with scarlet fever. It was not until the beginning of April that, foregoing my convalescence, I was able to start field investigations at Marg. Early in May the opening of the Gallipoli campaign, with its rush of wounded and the attendant excitement in Cairo, brought pressing local suggestions for the foreclosing of my mission. As on some other occasions, one found comfort in the aphorism of Huxley: "Surely there is a time to submit to guidance, and a time to take one's own way at all hazards."

But the pervading restlessness could not be wholly withstood. Later, in June, when it seemed advisable to transfer the work to London, my second colleague, whose assistance had been invaluable, decided to remain in Egypt for general service with the Royal Army Medical Corps. The position of the inquiry was full of anxious uncertainties, and I had still to complete many of the crucial experiments. The collections made in the field had still to be worked out, and the experimentally infected animals examined histologically. The extensive literature of Bilharziosis had to be overhauled. Finally, new experiments had to be made. These were the circumstances in which the preparation of the Report had to be undertaken, and sole responsibility assumed for the conclusions arrived at and for the views herein set forth.

To the various authorities who aided the investigations in Egypt, I have already expressed my deep indebtedness.

I have now to acknowledge the warm encouragement received from home authorities, especially from Colonel W. H. Horrocks, C.B., who found time amid heavy burdens to write emphasizing the practical objectives to be kept strictly in view; from the Medical Research Committee, who not only gave more than ample financial credit for the field expenses, and to illustrate this report, but also maintained, through Sir W. M. Fletcher, F.R.S., a gracious interest in the progress of the work.

Thanks are due to Sir David Bruce for privileges enjoyed under his command at Millbank, and to the officials of the Zoological Society of London, especially to Dr. Chalmers Mitchell and Mr. R. I. Pocock, F.R.S., for supervising the supply by dealers of properly identified *Cercocebus fuliginosus*, which were the mainstay of the experimental work.

Finally, I have to express my special indebtedness to the Committee of the London School of Tropical Medicine for most generously enabling me to continue under other auspices a series of investigations which they had initiated during 1913, and which they would probably have supported alone to a successful conclusion if more peaceful times had prevailed.

THE TREATMENT OF 102 CARRIERS OF *ENTAMŒBA HISTOLYTICA* WITH EMETINE BISMUTH IODIDE.

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(*Report to the Medical Research Committee from the Dysentery Convalescent Hospital, Barton-on-Sea, Lieutenant-Colonel J. Chaytor White, I.M.S., Commanding.*)

(1) Introduction.

The cases dealt with in this paper were discovered to be carriers of *Entamœba histolytica* in the course of the ordinary routine examinations of fæces in this Convalescent Hospital; none of them were found to be carriers of dysentery bacilli. They were all treated with emetine bismuthous iodide, and it has been thought worth while publishing the results, as this is the first time, so far as we know, that the drug has been tested on such a large scale. The treatment has had the advantage of being carried out under the supervision of one medical officer at a place where the necessary protozoological examinations could be made on the spot.

(2) Previous History of the Cases.

All the cases came into the hospital as convalescents after dysentery, fifty-two direct from hospital ships, the remainder from home hospitals.

With 9 exceptions all the cases were invalided from the Eastern Mediterranean area (87 cases) or Mesopotamia (6 cases). The other 9 cases were invalided from France; of these, 5 had exhibited dysenteric symptoms previously in Egypt, and 2 in Gallipoli, while another (10[1]) contracted dysentery in India in the autumn of 1914, just before being sent to France with a division of Indian troops; of the remaining case from France (1787) we have no further details.

Two other cases (1082, 1684) had previously had dysentery in India, in 1908 and 1914 respectively; but as one went subsequently to Gallipoli, and the other to Salonika, it cannot be said with certainty that they became infected with *E. histolytica* in India. Two cases had formerly had dysenteric symptoms in South Africa, one (787) in 1909, the other (1881) during the Boer War; while a third (1540) had "dysentery or enteric" in the Boer War.

Three cases (899, 1197, 1483) reported having diarrhœa with blood and mucus in France for a few days in 1915, before going to Salonika or Gallipoli; but it is

[1] The numbers in brackets refer to the case numbers, for which see Tables I and II.

impossible to say whether it was of amœbic origin. Seven cases which had dysentery in Gallipoli afterwards went to Salonika, where they all relapsed.

One case (902) had no history of acute dysentery; he was invalided from Salonika to Malta with nephritis, and, while in hospital there, was found to be passing cysts of *E. histolytica;* there seems no doubt he was a "contact carrier."

There is no direct evidence that in all cases the acute phase of the disease was due to *E. histolytica;* but since the majority of the cases have a history of more or less chronic or intermittent diarrhœa (even in England), with occasional relapses of an acute character, it may be presumed that in them this organism was the cause of the trouble.

A large number had been treated with emetine hypodermically, one or two having received as many as 100 injections. One case (1987) had been operated upon for liver abscess.

(3) Method of Treatment.

The form of the drug used was a keratin-coated tabloid (prepared by Burroughs Wellcome and Co.); each tabloid contained one grain of emetine bismuth iodide, and as a rule the daily dose, consisting of three grains, was given to each man after the mid-day meal. The time of giving the daily dose was decided by the men after trials of various hours; they were less disturbed by taking the dose at mid-day than at any other time, and objected strongly to its being given at night owing to night calls to the latrine. After having their dose at 1 p.m., all lay down and rested; during the earlier part of the day they were allowed out within the lines, and, being put into blue, they were easily kept under observation. The 102 cases were treated in various batches between September 15 and November 7, 1916, and the full course extended over twelve days, until thirty-six grains of emetine bismuth iodide had been taken. The men treated in the first batch, however, had only eight or nine doses, some of which consisted of two tablets instead of three, so that they had only from twenty-one to twenty-five grains each; and two or three others who did not tolerate the drug well, but suffered from great depression, also had less than the full amount. Each man was provided with a card on which was noted the daily dose and, opposite, the result—number of times sick and number of evacuations—which it produced. Each daily dose was administered by the medical officer's own hand. All the men were placed under the same conditions of living. The diet adopted comprised mainly milk, eggs, fish, puddings, mutton and cabbage, steamed and sieved.

(4) The Effects of the Treatment on the Men.

The behaviour of each case under this drug was very much the same; they practically all were either purged, or they vomited, or both. Usually a man who vomited much did not have so much diarrhœa, and a man who had much diarrhœa did not vomit so much; and usually whichever of the symptoms predominated at first, that was the most marked symptom

throughout. Very few were violently attacked both ways. Out of the 102 cases, only 2 or 3 were not affected at all, either by vomiting or diarrhœa, and a few had one natural evacuation daily; while 5 vomited only once (see tables for details). The worst cases had on some days 10 or 12 motions in 24 hours, or vomited 5 or 6, or even more times in the day. Of real tolerance of the drug there was none; certainly a number of men as time went on were not so often sick, but that was the best that could be said. The vomiting usually began about an hour after taking the dose, the diarrhœa not often sooner than three hours. Two men had violent colic and required fomentations. It was noted that in the vomit the brick-red colour of the drug was fairly often seen, showing that the keratin coat dissolved before reaching the intestine.

Various stomach and bowel sedatives were tried to control irritation, but none were of any real use except tinct. opii, and that was only used in extreme cases. The tabloids were tried in powder, but the vomiting was sooner produced and increased in intensity; so this was discontinued. A few of the most disturbed cases were kept entirely in bed, which relieved, but did not save them from, attacks of diarrhœa and vomiting.

In three cases of old carriers (1378, 787 and 10) the effect of the treatment on the general health was very pleasing. All three, particularly a staff-serjeant of the Indian Army, were weak, thin, pale and depressed; after the course appetite came back, weight was regained, and all three reported that they felt like new men. In most cases, however, the men were, for the time being, considerably pulled down by the vomiting and diarrhœa produced by the treatment. All were heartily glad when the ordeal ended and they were set free.

The tables show the curative properties which the drug certainly possesses; but until its preparation has been improved, and its intensely irritating properties abated or removed, a just estimation of its value in chronic dysentery cannot be made.

(5) Collection and Examination of Specimens.

It is obvious that the value of the microscopical examinations depends very largely upon the accuracy with which the identity of any particular specimen can be guaranteed. We think it wise to insist upon this fact, because in practice it is not easy, as might be supposed, to eliminate doubt. There are, in our experience, some men—we believe them to be few—who seem unable to realize the importance of the tests, and will exercise the utmost ingenuity in trying to substitute for specimens of their own fæces those of other men. In some cases this may be done as a joke; in others, a man, who suspects himself to be a positive, will endeavour to pass off as his own a specimen from a man known by reason of his approaching discharge to be free from infection. And even if the collection of specimens is so efficiently supervised that substitution is impossible,

one man may persuade another to impersonate him with the same object in view. Elaborate precautions are therefore taken at this hospital to prevent the mixing of specimens, and any sample about which there can be the slightest doubt is always rejected. We have reason to believe that in many hospitals the necessity for taking these precautions is not fully realized, and the tests made are, to a certain extent, unreliable in consequence.

The specimens were examined with the greatest care, and no test is recorded as negative unless at least two coverslip preparations, each from a different part of the fæces, had been searched without result. As a general rule the suspensions were made in normal saline, but iodine preparations were often used in addition. All problematical specimens, which were especially frequent immediately after treatment, were examined by both of the protozoologists at the hospital.

(6) Results of the Examinations.

In the accompanying tables will be found the exact amount of the drug received by each man, the period of treatment, the number of doses, the amount of vomiting and diarrhœa produced, and a list of all the tests made both before and after treatment. A date upon which *E. histolytica* was found is given in italics. An asterisk after the date denotes the presence of cysts, a dagger that of free amœbæ. The presence of only a small number of cysts is marked by one asterisk, of a moderate number by two asterisks, and of a large number by three asterisks ; while the number of free amœbæ present is indicated by a similar number of daggers.

The cases fall into two groups : (*a*) Those that may have been cured, and (*b*) those that definitely relapsed. It is convenient to deal first with the latter group.

(*a*) *The Cases that were not cured.*—There can be no doubt that in nineteen out of the 102 cases the treatment failed to cure the men of their infections of *E. histolytica*. It will be seen from the table that each of these cases had repeated positive tests after the end of treatment.

It is true that the finding of a small number of specimens of *E. histolytica* on one or two occasions after treatment does not necessarily indicate that the man had not been cured. Thus, in Case 1299, two or three free amœbæ were found on the eighth day after treatment, and although the next two examinations were negative, one or two cysts of *E. histolytica* were found on November 24, twenty-six days after treatment ; but since then the case has been examined fifteen times in the ensuing nine weeks, each time with a negative result ; it therefore seems justifiable to include him among the probably cured. In about half a dozen other cases a few degenerate cysts, which might possibly have been those of *E. histolytica*, were found after the end of treatment (nearly always among large numbers of *E. coli* cysts). These cases were kept under observation longer than would otherwise have been the case, but as the small cysts did not recur, the tests have been recorded as negative.

In the nineteen cases that were not cured, undoubted examples of *E. histolytica* were found, often in large numbers, on at least two occasions after treatment; and the presence of the organism has been confirmed in each case by other workers since the men left the hospital.

Fifteen of these cases were examined at least once during treatment, and fourteen of them were then found to be negative. It is well known, however, that carriers of *E. histolytica* do not always pass cysts every day, at any rate in sufficient numbers to be found in practice (*vide* the examinations before treatment in the tables); the fact that many of these men had one negative examination during treatment does not, therefore, necessarily indicate that they all cleared up temporarily owing to the action of the drug. It was, however, found impracticable to make several examinations of the men while under treatment; and indeed for all practical purposes it is the examinations after treatment that are the most important.

One semi-acute case (787) had a double course of treatment. His general health improved, but at every examination numerous active amœbæ were found in the stools, and this continued after he left Barton. He has since been operated upon for amœbic abscess of the liver.

Another semi-acute case (10) also improved considerably in general health after treatment, but continued to pass at intervals sporadic active specimens of *E. histolytica*. At Barton he had three full courses of the drug, the third course being given towards the end of November. After leaving the depot he was reported to have passed on December 18 and 19 large numbers of cysts of *E. histolytica*, and smaller numbers of them on the 20th and 21st (no cysts were ever found at Barton), which disappeared under a further course of the drug. Unfortunately the man has gone back to India before his complete cure could be established.

It is difficult to assign any reason for the failure of these nineteen cases. It is possible that in some of them the full effect of the drug was not obtained, owing to a portion of the drug being lost through vomiting or diarrhœa; on the other hand, some of the worst cases in this respect are among those apparently cured (e.g., 968, 1540, 1628, 1686). Moreover, of the first batch of men treated all had considerably less than a full course of the drug, while among them only two cases definitely relapsed.

Another possible reason for some failures may be the form of drug used. In all the cases previously reported upon [2] the drug was given as a powder enclosed in gelatine capsules. Perhaps in some cases the compressed keratin-coated tablets used at Barton may not have got thoroughly broken up and some of the effect may thus have been lost. Nevertheless, the general production of intestinal disturbances and malaise tend to show that the drug did have some effect. It is possible that had the capsules been pounded up and put in cachets a more satisfactory result would have been obtained. (It is true that powdering the tablets was tried on one occasion at Barton, but, from the accounts of some of the men, the powder formed a kind of cement

TABLE I.—Cases that are not known to have relapsed after Treatment.

Lab. No. of case	Total number of grains of E.B.I. given	Period of treatment	Number of doses	During treatment				Dates of protozoological examinations, those on which *Entamœba histolytica* was found being in *italics*		Number of neg. tests after end of treatment	Number of days between last dose and last test
				Total number of vomits	Max. number on one day	Total number of motions (approx.)	Max. number on one day	Examinations before third day of treatment	Examinations after third day of treatment		
318	21	Sept. 15—22 ..	8	11	5	8	2	Aug. *22***	Sept. 21, 23, 30, Oct. 2, 4, 5, 10, 21	7	29
814	21	Sept. 15—22 ..	8	11	4	17	5	Aug. *23**	Sept. 21, 23, 30, Oct. 2, 4, 5, 10	6	18
940	21	Sept. 15—22 ..	8	9	3	28	6	Sept. 6, *7*†	Sept. 21, 30, Oct. 3, 4	3	12
960	21	Sept. 15—22 ..	8	12	5	19	4	Sept. *6****	Sept. 21, 23, 29, 30, Oct. 2 ..	4	10
1103	21	Sept. 15—22 ..	8	2	1	14	2	Aug. *23***	Sept. 21, 23, 30, Oct. 2, 4, 10 ..	5	18
1291	21	Sept. 15—22 ..	8	11	4	26	5	Aug. *26*,* *28*†*	Sept. 21, 23, 29, Oct. 2, 4 ..	4	12
1359	21	Sept. 15—22 ..	8	8	4	14	4	Aug. *19*,* 24	Sept. 22, 23, 30, Oct. 2, 4, 10 ..	5	18
1003	22	Sept. 15—22 ..	8	19	5	31	10	Sept. *8*†	Sept. 21, 23, Oct. 2, 3, 4 ..	4	12
738	24	Sept. 15—23 ..	9	7	4	18	4	Aug. *17*,* *27**	Sept. 22, 23, 25, 30, Oct. 5, 6 ..	4	13
975	24	Sept. 15—23 ..	9	8	3	16	3	Sept. *7****	Sept. 21, 25, Oct. 2, 4, 5 ..	4	12
1082	24	Sept. 15—23 ..	9	11	4	20	5	Aug. *30**	Sept. 22, 25, 30, Oct. 2, 4, 10 ..	5	17
1138	24	Sept. 15—23 ..	9	6	2	13	2	Aug. *21****	Sept. 22, 25, 29, Oct. 3, 4, 11 ..	5	18
1181	24	Sept. 15—23 ..	9	6	3	33	8	Aug. *21***	Sept. 22, 25, 29, Oct. 2, 4 ..	4	11
1436	24	Sept. 15—23 ..	9	3	3	36	10	Aug. *22*†	Sept. 22, 25, 29, Oct. 3, 4, 5, 11, 12, Nov. 2	8	40
1532	24	Sept. 15—23 ..	9	11	3	13	3	Sept. *6****	Sept. 22, 25, 30, Oct. 2, 4, 5 ..	5	12
1574	24	Sept. 15—23 ..	9	7	4	16	2	Aug. *28**	Sept. 22, 25, 30, Oct. 2, 4, 5, 10	6	17
879	25	Sept. 15—23 ..	9	1	1	9	1	Sept. *12****	Sept. 22, 25, 29, Oct. 3, 4, 11 ..	5	18
1540	27	Sept. 29—Oct. 10	12	35	12	23	5	Aug. *26*,* Sept. *8*,* 30	Oct. 7, 13, 17, 21, 28	4	18
968	30	Oct. 12—24 ..	11	18	5	51	10	Sept. *27*,* *28*,** Oct. *11** ..	Oct. 25, 30, Nov. 1	3	8
935	33	Oct. 12—23 ..	12	16	4	39	6	Sept. *7*,† *27*,* Oct. 13	Oct. 25, 30, Nov. 2	3	10
1475	33	Sept. 28—Oct. 9	12	18	4	44	7	Aug. *24*,* Sept. *27***	Oct. 5, 13, 17, 19, 26	4	17
1788	34	Sept. 29—Oct. 10	12	3	2	23	3	Sept. *16**	Oct. 8, 16, 18, 20, 23, 28, Nov. 2	6	23
1197	35	Sept. 28—Oct. 9	12	28	4	34	12	Sept. 4, *8*,** *27**	Oct. 6, 16, 17, 21, 30	4	21
1380	35	Sept. 29—Oct. 10	12	17	2	38	5	Aug. *21**, Sept. 28	Oct. 7, 13, 17, 19, 26	4	16
845	36	Sept. 28—Oct. 9	12	..	..	16	2	Sept. *11*,** *28**	Oct. 6, 13, 17, 19, 26	4	17
849	36	Sept. 29—Oct. 10	12	13	3	23	2	Sept. *11*,** 30	Oct. 6, 13, 17, 19, 26	4	16
855	36	Oct. 12—23 ..	12	5	3	43	6	Sept. 4, 8, *11*,* 16, *22*,*** Oct. 11	Oct. 25, 30, Nov. 1, 6, 8, 23 ..	6	31
965	36	Oct. 12—23 ..	12	13	3	27	3	Sept. *14*,*** *23*,*** Oct. *11*** ..	Oct. 25, 30, Nov. 1, 6	4	14

978	36	Oct. 12—23 ..	12	2	1	23	4	Sept. 14, *27*,*** Oct. *11** ..	Oct. 26, 30, Nov. 1, 2	4	10
1299	36	Sept. 28—Oct. 9	12	8	2	18	2	Sept. *8*,* 27	Oct. 6, 13, *17*,† 19, 26	3	17
1328	36	Oct. 12—23 ..	12	8	2	42	6	Aug. *18*,**† Sept. *27*,** Oct. *11***	Oct. 25, 30, Nov. 2, 6, 24 ..	5	32
1329	36	Sept. 28—Oct. 9	12	..	..	17	4	Aug. *18*,* Sept. 27	Oct. 7, 13, 17, 19, 30	4	21
1330	36	Sept. 28—Oct. 9	12	..	..	15	4	Aug. 18, Sept. *8*,*** *27** ..	Oct. 6, 14, 17, 19, 30	4	21
1356	36	Oct. 12—23 ..	12	2	1	34	6	Aug. 19, Sept. *16**	Oct. 25, 30, Nov. 2	3	10
1372	36	Oct. 12—23 ..	12	2	1	15	2	Aug. 21, Sept. *15*,*** Oct. 11 ..	Oct. 25, 30, Nov. 1	3	9
1378	36	Sept. 30—Oct. 11	12	6	3	17	3	Aug. *21*,* Sept. 27	Oct. 8, 14, 17, 19, 26	4	15
1402	36	Oct. 12—23 ..	12	8	2	31	4	Aug. 22, Sept. *13*** 27, Oct. 11..	Oct. 25, 30, Nov. 1	3	9
1450	36	Sept. 28—Oct. 9	12	13	2	16	2	Aug. *23*,* Sept. *11*,* 27	Oct. 5, 16, 17, 19, 28	4	19
1454	36	Sept. 28—Oct. 9	12	..	..	23	4	Aug. *23*,††† Sept. 27, 30 ..	Oct. 7, 13, 17, 19, 26	4	17
1472	36	Sept. 28—Oct. 9	12	7	2	29	5	Aug. *24**** Sept. *27**	Oct. 7, 13, 17, 19, 26	4	17
1483	36	Sept. 28—Oct. 9	12	14	4	19	3	Aug. *24*,* Sept. *9*,** *22*,* *28** ..	Oct. 5, 14, 17, 19, 28	4	19
1490	36	Sept. 28—Oct. 9	12	..	..	18	3	Aug. *24*,* Sept. *27**	Oct. 6, 13, 17, 19. 26	4	17
1514	36	Sept. 28—Oct. 9	12	3	2	21	3	Aug. *25*,* Sept. *7*,††* *27** ..	Oct. 6, 14, 17, 19. 28	4	19
1517	36	Sept. 28—Oct. 9	12	7	2	19	4	Aug. *25*,* Sept. *7*,*** Sept. *28***	Oct. 6, 14, 17, 19, 21, 25, 28, 31, Nov. 2, 6	9	28
1522	36	Sept. 28—Oct. 9	12	1	1	24	4	Aug. *25*,* Sept. 7, 28	Oct. 6, 14. 18, 20, 28	4	19
1525	36	Sept. 28—Oct. 9	12	5	2	22	2	Aug. *25*,* Sept. *7*,* *28**	Oct. 6, 9, 14, 18, 20, 28	4	19
1527	36	Sept. 28—Oct. 9	12	12	2	27	3	Aug. *25*,*** Sept. *11*,*** *30*** ..	Oct. 5, 14, 20, 21..	3	12
1539	36	Sept. 28—Oct. 9	12	1	1	35	4	Aug. *26*,** Sept. *8*,*** 28 ..	Oct. 5, 14, 18, 20, 28	4	19
1583	36	Sept. 28—Oct. 9	12	12	3	27	3	Aug. 28, Sept. *7*,* *28*,*** ..	Oct. 6, 12, 16, 20, 27	4	18
1585	36	Sept. 28—Oct. 9	12	1	1	41	6	Aug. 29,* Sept. *28****	Oct. 7, 13, 18, 21..	3	12
1622	36	Oct. 12—23 ..	12	..	..	12	1	Aug. 30, Sept. *18*,** Oct. *10****	Oct. 24, 27, 31, Nov. 2, 9, 13 ..	6	21
1628	36	Oct. 12—23 ..	12	25	6	28	3	Aug. 30, Sept. 25, Oct. *4*,* *5*,* 6, 9, 10, *11**	Oct. 24, 31, Nov. 2, 7, 10 ..	5	18
1650	36	Sept. 29—Oct. 10	12	15	3	25	4	Aug. *31*,** Sept. *30**	Oct. 7, 12, 16, 18, 24, 27 ..	5	17
1653	36	Sept 28—Oct. 9	12	2	1	37	5	Aug. *31*,*** Sept. 30	Oct. 7, 12, 16, 18. 27 . ..	4	18
1656	36	Oct. 12—23 ..	12	12	3	21	2	Aug. 31, Sept. *19*,***25, Oct. *13***	Oct. 24, 26, 27, Nov. 2	4	10
1658	36	Sept. 28—Oct. 9	12	2	1	32	5	Aug. *31*,* Sept. *30**	Oct. 5, 12, 16, 18, 24, 28 ..	5	19
1661	36	Sept. 28—Oct. 9	12	12	3	32	4	Aug. *31*,* Sept. *30**	Oct. 7, 12, 16, 18. 24, 27 ..	5	18
1686	36	Sept. 28—Oct. 9	12	29	5	31	5	Sept. *1*††	Oct. 8, 12, 16, 21, 27	4	18

TABLE I.—CASES THAT ARE NOT KNOWN TO HAVE RELAPSED—*Continued.*

Lab. No. of case	Total number of grains of E.B.I. given	Period of treatment	Number of doses	During treatment				Dates of protozoological examinations, those on which *Entamœba histolytica* was found being in *italics*		Number of neg. tests after end of treatment	Number of days between last dose and last test
				Total number of vomits	Max. number on one day	Total number of motions (approx).	Max. number on one day	Examinations before third day of treatment	Examinations after third day of treatment		
1712	36	Sept. 28—Oct. 9..	12	12	2	40	6	Sept. *4*,* 30	Oct. 5, 12, 16, 18..	3	9
1718	36	Sept. 28—Oct. 9..	12	20	3	47	7	Sept. *4*,* *19*.* *30**	Oct. 6, 12 16, 18, 27	4	18
1727	36	Sept. 28—Oct. 9..	12	2	2	33	5	Sept. *4*,** 19, *26*,** *28**	Oct. 5, 12, 16, 18	3	9
1734	36	Oct. 12—23 ..	12	10	2	15	2	Sept. 4, 19, Oct. *2*,** *10*** ..	Oct. 24, 27, 31, Nov. 2	4	10
1735	36	Sept. 28—Oct. 9..	12	22	3	35	5	Sept. *4*,* *25*,* *28**	Oct. 6, 12, 16, 19, 27	4	18
1754	36	Sept. 29—Oct. 10	12	3	1	15	2	Sept. 8. *15*,* 30	Oct 16, 18, 19, 26	4	16
1755	36	Sept. 28—Oct. 9..	12	12	3	11	1	Sept. *5*,* *30****	Oct. 7, 12, 16, 18	3	9
1783	36	Oct 12—23 ..	12	9	3	19	3	Sept. *15*,*** Oct. *11***	Oct. 25, 30, Nov. 1	3	9
1787	36	Oct. 12—23 ..	12	20	4	35	5	Sept. *15*,** Oct. 11	Oct. 26, Nov. 2, 4	3	12
1793	36	Oct. 12—23 ..	12	4	3	22	3	Sept. *18*,* Oct. *10***	Oct. 27, 31, Nov. 2	3	10
1834	36	Oct. 12—23 ..	12	6	3	35	3	Sept. *29*,* Oct. *5*,** 9, *11*** ..	Nov. 10, 13, 14	3	22
1867	36	Oct. 12—23 ..	12	19	5	27	6	Oct. *2*,* *10****	Oct. 24, 27, 31, Nov. 2	4	10
1868	36	Oct. 12 23 ..	12	5	2	16	3	Oct. *2*,* *16**	Oct. 24, 27, 31, Nov. 2	4	10
1904	36	Oct. 12—23 ..	12	1	1	21	3	Oct. *4*,**** 10	Oct. 24, 27, 31, Nov. 2	4	10
1911	36	Oct. 12—23 ..	12	3	1	39	4	Oct. *5*,** *11**	Oct. 25, 30, Nov. 1	3	9
1941	36	Oct. 12—23 ..	12	7	2	25	3	Oct. *6*,** *11***	Oct. 27, 31, Nov. 2	3	10
1963	36	Oct. 27—Nov. 7..	12	12	2	26	5	Oct. *10*,†* *16*††**	Nov. 13, 15, 20, Dec. 4, 6 ..	5	29
1974	36	Oct. 27—Nov. 7..	12	5	2	29	4	Oct. *10*****	Nov. 13, 15, 20, 29, Dec. 12 ..	5	35
1982	36	Oct. 27—Nov. 7..	12	9	3	28	3	Oct. *10*,* *26***	Nov. 16, 18, 20, 28, Dec. 7 ..	5	30
1987	36	Oct. 27—Nov. 7..	12	11	2	27	3	Oct. *12*,* *16*,**** 18	Nov. 13, 15, 20, Dec. 1, 6 ..	5	29
2031	36	Oct. 27—Nov. 7..	12	6	2	39	5	Oct. *14*,†****	Nov. 13, 15, 20, 29	4	22
2063	36	Oct. 27—Nov. 7..	12	4	1	37	4	Oct. *16**	Nov. 13, 16, 20	3	13
2084	36	Oct. 27—Nov. 7..	12	18	3	20	3	Oct. *17*,† 29	Nov 15, 18, 22, 24, 28, Dec. 5, 7..	7	30
2191	36	Oct. 27—Nov. 7..	12	2	1	33	4	Oct. *20*****	Nov. 13, 14, 15, 21, 28, Dec. 7..	6	30
2195	36	Oct. 27—Nov. 7..	12	18	3	17	2	Oct. *20***..	Nov. 13, 18, 20, 28, Dec. 7 ..	5	30

TABLE II.—CASES THAT WERE NOT CURED BY THE TREATMENT.

Lab. No. of case	Total number of grams of E.B.I. given	Period of treatment	Number of doses	During treatment				Dates of protozoological examinations, those on which *Entamœba histolytica* was found being in *italics*		Number of neg. tests between treatment and first pos. test	Number of days between treatment and first pos. test
				Total number of vomits	Max. number on one day	Total number of motions (approx.)	Max. number on one day	Examinations before third day of treatment	Examinations after third day of treatment		
899	21	Sept. 15—22 ..	8	11	4	19	6	Sept. *12**	Sept. 21, 23, 29, Oct. 4, *5*** *9*, *11*,* 21, 26, Nov. *10*†	3	13
1393	24	Sept. 15–23 ..	9	11	5	16	4	Aug. *21****	Sept. 22, 25, *30*,* Oct. *3*,** 4, 5, *10*,** 21, *24****	1	7
902	36	Sept 28–Oct. 9..	12	4	1	18	2	Sept. *12*,* *27**	Oct. 7, 13, 17. *19*,* *21*,*** *28*** ..	2	10
1324	36	Oct. 12–23 ..	12	19	4	24	4	Aug. 18, *Sept. 8*,* *28*,* Oct *11***	Oct. 26, *30*,* Nov. *3*****	1	7
1428	36	Oct. 12–23 ..	12	23	3	27	4	Aug. 22, Sept. *14* ** Oct. 11 ..	Oct. *25*,* *30*,** Nov. *1*** ..	0	2
1444	36	Sept 28–Oct. 9..	12	14	3	35	4	Aug. *23*,* Sept. *27***	Oct. 7, *13*,* *17*,* *19*,* *28** ..	0	4
1553	36	Sept. 28–Oct. 9..	12	11	2	31	4	Aug 26, Sept. *7*,** *28**	Oct. 7, *17*,*18*,* *21***** *28** ..	0	8
1614	36	Oct. 12–23 ..	12	9	2	11	2	Oct. *10***	Oct. 24, Nov. *2*,* *13*,***** *14** ..	1	10
1684	36	Oct. 12–23 ..	12	7	2	46	5	Sept. *1*,†† Oct. 5, *11**†	Oct. 25, *30*,***** Nov. 1, *6***** ..	1	7
1688	36	Sept. 28 Oct. 9..	12	8	3	25	3	Sept *2*,* *28***	Oct. 5, *14*,* 18, *20***	0	5
1690	36	Sept. 28—Oct. 9..	12	2	2	21	2	Sept. *2* ** *28***	Oct. 6, 8, *14*,** *18*,* *26*** ..	0	5
1763	36	Oct. 12 23 ..	12	8	2	11	1	Sept. *14*,†† Oct. *1**	Oct. 25, *30*,* Nov. *1*,* *6*** ..	1	7
1765	36	Oct. 12—23 ..	12	15	3	26	3	Sept. *14*,***** *23**, Oct. 11 ..	Oct. 25, 30, Nov. *1*,*** *6*,* 8, 9, *13*,* *14**	2	9
1847	36	Oct 12—23 ..	12	21	3	12	2	Sept. *29*,* Oct. 11	Oct. 25, 30, Nov. *1*,***** *6*** ..	2	9
1881	36	Oct. 12–23 ..	12	8	4	15	2	Oct. *3*,***** 10	Oct. *24*,* *27*,* *31*****	0	1
2089	36	Oct. 27—Nov. 7..	12	7	1	37	4	Oct. *17*****	Nov. *13*, ***** *15*****	0	6
2122	36	Oct. 27–Nov. 7..	12	12	3	23	4	Oct. *18**	Nov. *14*,* 15. *21*****	0	7
787	63	Sept. 15—Oct. 9..	22	5	1	60	5	Sept. *12*††	Sept. *21* ††† *23*,†† *27*,†† *29*††* Oct. *4*,††† *8*,†† *16*††	0	7
10	72	Sept. 29—Oct. 23	24	18	2	53	8	Sept. *28*,†† *29*,††† *30*,†††† Oct. *1**	Oct. 2. 3 4, 5, 6, 7, 8. *9*,†† *10* †† 12, 13, 14. 16, 17. 18, 19, *20*,† 21, 22, *24*.† 25, 26. 27, Nov. 8, *11*,† 12, *14*,† *15*.† 17	0	1

on the tongue and was difficult to swallow : a cachet or capsule would overcome this difficulty.) On the other hand, one case (C. 26) at Chichester [3] was not cured by a course of forty grains of the powdered drug, though he may have been cured by a subsequent course of sixty-eight grains.

The duration of infection or the region where it was acquired may possibly have some effect, for it is noteworthy that four out of the five men who are known to have had dysentery previously in South Africa or India (viz., 10787, 1684, 1881) were among those who relapsed. There is no evidence however that the failure is in any way connected with the intensity or duration of the acute symptoms : indeed, among the relapses is included the one case that had never had any symptoms of acute dysentery (902).

Dobell has shown that emetine hydrochloride fails to cure about two-thirds of the cases treated. It seems to us that while emetine bismuth iodide is a much more efficient drug, nevertheless, at any rate in the form used at Barton, it may fail to extirpate about twenty to twenty-five per cent of *E. histolytica* infections. Again, a man who has once relapsed after emetine hydrochloride injections is very seldom cured by a further course of the drug [4], and similarly the two cases (10 and 787) which had more than one course of emetine bismuth iodide at Barton were still not cured. All the cases that relapsed at Barton have again relapsed after another full course of the drug, with the exception of three men (899, 1393, and 1765). Of these 1393 has been under observation since treatment for eight weeks, during which he has had nine examinations, all negative, while 1765 has had, similarly, six negative examinations in five weeks, and it seems likely, therefore, that both these cases have been cured.[1] The other case has only had four negative examinations (three within eight days of the end of treatment) and his "cure" is therefore much more open to doubt. It seems possible, however, that there may be some cases which are permanently resistant to emetine bismuth iodide.

(b) Cases that were apparently cured.—While there can be no doubt about the cases that relapsed, it is by no means so certain that the remainder were permanently cured ; for it is conceivable that some relapsed after they were last examined. The evidence of cure depends upon the value of the negative examinations, and until we know more about the way in which the presence of *E. histolytica* in the fæces of relapsing carriers may vary from day to day, it is impossible to speak with certainty.

We can, however, draw certain conclusions from the behaviour of the

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[1] Since this paper was written both these cases have relapsed. 1393 had twelve negative examinations after treatment at Mont Dore Hospital between the end of November and the middle of February, 1917 ; he had another negative test at Barton on February 17. He was subsequently reported to be passing blood in his stools and a further examination on March 6 revealed the presence of large numbers of cysts of *E. histolytica.* In view of the long period during which this case was negative it is probable that the opinion expressed at the end of paragraph 6 (*b*) above, concerning late relapses, will have to be somewhat modified.

cases that did relapse. The table shows that cysts generally reappeared in the faeces fairly soon after treatment had ceased: thus, out of the 19 cases, 10 were discovered still to be infected on the first, 5 on the second, 3 on the third, and 1 on the fourth examination after treatment. The average number of days between the last dose and the first positive test was only 6·5; and it is probable that, had daily examinations been made, it would have been much smaller. The longest period between the last dose and the last negative test was never more than 8 days, except in 1 case where it was 4 days longer.

The remaining cases, on the other hand, had an average of 4·3 negative tests after the end of treatment, the average number of days between the last dose and the last test being 17·3. Only 1 case did not have at least 1 examination later than the eighth day after the end of treatment, and many had 3 or 4; indeed, if we take the 65 cases that had 12 doses, we find that they had altogether 144 negative tests later than the eighth day after the end of treatment, an average of over 2 per man.

It is improbable, therefore, that, had many cases relapsed later, some would not have been detected: and the foregoing facts, together with what we know of other cases followed over longer periods [5], warrant us in the belief that the majority of these eighty-three cases may really have been permanently cured.

(7) On the Amount of Emetine Bismuth Iodide necessary to affect a Cure.

Nineteen cases had only 8 or 9 doses, amounting to 21-25 grains of the drug, and other 7 had also less than 36 grains: yet of these 26 cases only 2 (899 and 1393) definitely relapsed. Most of the others had at least two negative tests subsequent to the eighth day after treatment, and in only nine cases was the last test previous to the thirteenth day after treatment. On the other hand, the two cases that relapsed are among the three that seemed to have cleared up permanently after the second course of treatment (*vide supra* 6 (*a*), last paragraph), and it seems possible that on the first occasion they did not get sufficient of the drug.

It appears, therefore, that while there are undoubtedly cases which clear up under a smaller amount of the drug [6], it is preferable to give the full course of thirty-six grains as a general rule. But if the ill effects of the treatment on a man's general health are very marked, it would seem quite justifiable to give a somewhat shorter course, inasmuch as it seems likely that the first eight or nine doses of the drug may cure the great majority of those cases which it can cure at all.

(8) Length of Time during which it is advisable to keep Patients under Observation after Treatment.

If all cases could be cured by the drug, as early work seemed to indicate, no examinations after treatment would of course be necessary. Our observations, however, seem to show that we may expect twenty to twenty-five

per cent of failures; and although this is a much better result than that obtained with emetine hydrochloride, yet it indicates that the success of the treatment should be checked by adequate protozoological supervision, if the end aimed at is the elimination of the convalescent carrier, in which case it is important that relapses should be detected.

The results detailed above seem to show that in the majority of cases that are going to relapse cysts will be found in the fæces within a very few days of the end of the treatment, and somewhat earlier, apparently, on an average than in cases that relapse after treatment with emetine hydrochloride. One case, however, was not detected until the thirteenth day after completing his course, and if examinations are only made at intervals of a few days, some such cases are bound to escape earlier detection.

Again, it is evident that negative examinations made during or immediately after treatment are of very little value. Leaving out No. 10, which case was examined daily, nine out of the remaining eighteen cases were negative upon their first examination after treatment. In all they were examined 77 times after treatment, and 30 of these examinations (nearly 40 per cent) were negative, while 6 cases had 2 or more negative examinations.

From these considerations, therefore, it would appear advisable that cases which have been treated with emetine bismuth iodide should be kept under observation for not less than a fortnight after the completion of treatment, during which time as many tests as possible (certainly not less than four) should be made.

(9) Effects of Treatment on other Protozoa.

Fifty-six of the carriers treated were found to be infected with *E. coli*, in 13 of whom it was found once only. In 11 cases it was found only before, and in 11 others only after, treatment. It appears to be at least temporarily affected by the drug, disappearing during treatment, but generally reappearing sooner or later. There is, moreover, a remarkable similarity in the usual time of its reappearance to that of *E. histolytica* in the cases that relapsed. Thus, omitting the 11 cases in which it had not been found before treatment, it reappeared in 19 cases on the first, 12 on the second, and 3 on the third examination after treatment. The average number of days between the last dose and its reappearance was 6·05 (compared with 6·5 for *E. histolytica*), and the longest period between the last dose and the last negative test before its reappearance was 8 days, as in the case of *E. histolytica*, except in 1 case where it was 11. Thus in general its behaviour is strikingly similar to that of *E. histolytica* in those cases that relapsed.

On the other hand, the flagellate parasites of the small intestine appeared to be unaffected by the drug. *Giardia* (*Lamblia*) was found in 29 of the 102 cases, usually in the encysted form; it was present in the fæces on ten occasions during treatment.

Chilomastix occurred in 12 cases; the unencysted form was less uncommon than that of *Giardia*, being present on 7 occasions, 4 of them during treatment.

Trichomonas was found in two cases only, on the same date during treatment.

Conclusions.

(1) Emetine bismuthous iodide is much more effective than emetine hydrochloride in the treatment of carriers of *E. histolytica*, but about twenty to twenty-five per cent of failures may occur.

(2) The intensely irritating properties of the drug in many cases are a drawback in its general application.[1]

(3) The definite failure to cure nineteen out of the 102 cases treated at Barton may perhaps be in part due to the form of drug employed (a keratin-coated tabloid).

(4) It is improbable that there were many relapses later than those discovered; and as several of the cases had only 8 or 9 doses instead of 12, it seems likely that less than 36 grains may be effective.

(5) It is advisable to keep cases under observation for not less than fourteen days after treatment, and to examine them not less than four times during that period, if relapses are to be detected.

(6) The drug is without appreciable effect upon the intestinal flagellates, but has an effect, usually temporary, on *E. coli*.

Acknowledgments.

For information relating to cases which were afterwards treated and studied at Mont Dore Military Hospital, Bournemouth, we are indebted to Captain Shepherd, R.A.M.C., and Mr. D. G. Lillie; for information regarding Case 10 to Dr. G. C. Lord. Captain Cambell, R.A.M.C., of Hilsea Military Hospital, kindly enabled us to continue our observations on Case 1974.

References.

[1] *Cf. also* Dobell: "Amœbic Dysentery and the Protozoological Investigation of Cases and Carriers," *Medical Research Committee, Special Report Series*, No. 4, 1, January, 1917.

[2] *See* Dale: "Treatment of Carriers of Amœbic Dysentery, &c.," *Lancet*, July 29, 1916. Low and Dobell: "Three Cases of *Entamœba histolytica* Infection treated with Emetine Bismuth Iodide," *Lancet*, August 19, 1916. Dobell: "Incidence and Treatment of *Entamœba histolytica* Infection at Walton," *British Medical Journal*, November 4, 1916.

[3] Dobell: January, 1917, *loc. cit.*, pp. 80 and 81.

[4] *Ibid.*, p. 76.

[5] *See* Dobell: November, 1916, *loc. cit.*, remarks on fourth series, and January, 1917, *loc. cit.*, p. 81.

[6] *Cf.* Low and Dobell: *Loc. cit.*, Case 3.

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[1] Since the above was written a new preparation of the drug in the form of salol-coated pills has been introduced by Dr. H. H. Dale: we are informed that this preparation of the drug is much less irritating than that used at Barton.

FUSO-SPIROCHÆTAL AFFECTIONS OF THE MOUTH AND PHARYNX.

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Prior to the end of the last century most of these affections, from their clinical appearance, were doubtless classed with diphtheria and croup. Since Klebs in 1882 investigated the specific cause of diphtheria, these fuso-spirochætal affections, owing to the advances in bacteriology, have gradually become differentiated and now form well defined clinical entities. Although their early history is so recent, it is not quite clear to whom the honour belongs of first describing the organisms with which they are associated.

By some it is ascribed to Babes [1] (1884), while others award the distinction to Miller [2], an American practising dentistry in Germany, who mentioned organisms, similar if not identical to those found, as early as 1882. Plaut [3] certainly described and pictured the organisms in 1894 and his name is often coupled and applied with that of Vincent to the associated bacillus as the Plaut-Vincent organism. Vincent [4] in 1896 described the spindle-shaped bacillus in hospital gangrene and gave it the name fusiform bacillus.

In 1898 and 1899 Vincent further elaborated and published his researches on the organisms and their associated affections of the mouth and tonsils, and the affection of the latter has since been known as "Vincent's angina," and the organisms found are frequently spoken of as Vincent's organisms or *Bacillus vincenti* and *Spirochæta vincenti*.

Vincent's publications appear to have attracted considerable attention and possibly stimulated research, for since their appearance many diseases have been recorded associated with the fuso-spirochætal organisms and many papers dealing with the bacteriological properties of the organisms have appeared in the medical literature of Europe and America.

In England fuso-spirochætal affections of the mouth and tonsils appear to have scarcely received the attention they deserve, for few contributions on them are to be found in our journals and in some of our recently published text-books they have not yet secured a place, while in others they are dismissed as if clinical rarities. In fact, as far as my inquiries go, the English literature of these affections is almost exclusively devoted to Vincent's angina, while the affections of the gums, the *fons et origo* of Vincent's angina and allied ulcerations of the palate, cheek, etc., have scarcely been mentioned.

That the affections are very prevalent among soldiers the number of cases met with at Queen Alexandra Military Hospital proves, and there are reasons to doubt that the civil population is as free from the affections

as our literature on the subject leads us to believe. Out of two hundred and thirty healthy recruits—men who had not yet left their homes for military service—I found fusiform bacilli and spirochætæ in the mouths of ninety-five.

Geographical Distribution.

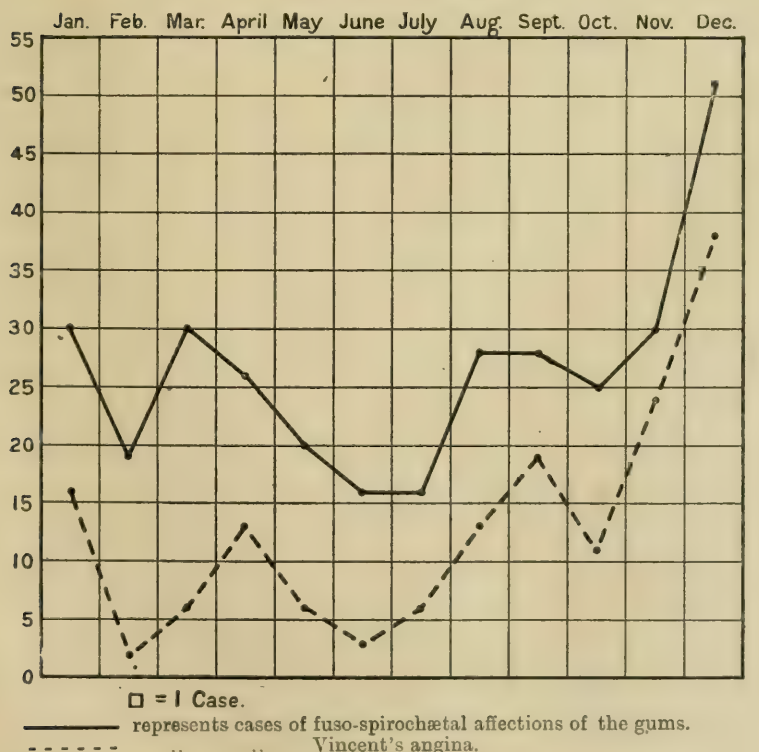
Fuso-spirochætal affections of the mouth and tonsils appear to be distributed over a wide area of the globe both North and South of the Equator. They have been recognized in all European countries, Canada, United States, Australia, New Zealand, and I am informed by officers of the Indian Medical Service that ulceration of the gums due to these organisms is prevalent in India, particularly among the European section of the community.

Table of Cases of Vincent's Angina.

January ..	16	July ..	6
February ..	2	August ..	13
March ..	6	September ..	19
April ..	13	October ..	11
May ..	5	November ..	24
June ..	3	December ..	38

Table of Cases of Fuso-spirochætal Ulceration of the Gums.

January ..	30	July ..	16
February ..	19	August ..	28
March ..	30	September ..	28
April ..	26	October ..	25
May ..	20	November ..	30
June ..	16	December ..	51



Seasonal Variation.

Acute tonsillar affections in this country usually show a seasonal variation, occurring most frequently in spring and autumn. Dr. J. D. Rolleston [5] published a paper on thirty-two cases of Vincent's angina observed in children, and therein stated he found Vincent's angina commonest in spring and rarest in autumn.

Above are monthly tables of the numbers of cases of Vincent's angina and fuso-spirochætal ulcerations of the gums met with at Queen Alexandra Military Hospital during the year 1916.

From the above tables it will be observed the diseases are commonest during the winter months, and the numbers of cases of Vincent's angina rise and fall with the cases of fuso-spirochætal ulceration of the gums. These facts are well brought out in the accompanying graph. But it is to be remembered that the conditions of life have so materially changed in the present state of stress, it is obviously unsafe to draw any general conclusion of seasonal variation from the above tables.

Occupation and Age.

Nearly all my cases occurred in soldiers; the only exceptions were three nurses and three wives of officers. The ages of those affected varied between 16 and 60.

Predisposing Causes.

Vincent laid special stress on general ill-health and oral sepsis. Cold, damp and insanitary surroundings have also been mentioned as contributing causes. Bruce [6], Halsted [7] and others have reported cases in diseased and debilitated subjects running on to fatal endings.

Nearly all my cases occurred in young, robust, healthy-looking men. Overcrowding and its concomitants may be a predisposing cause, as many cases came from barracks possibly overcrowded as a result of the War. On the other hand, a large proportion of cases were officers living in billets or at their own homes. There can be no doubt that oral sepsis plays a very important part; about thirty per cent of the cases seen by me showed decayed teeth, and a larger proportion want of oral cleanliness. In a large number of the latter the mouth toilet had been discarded on account of the pain and the bleeding excited.

Drs. Harwood-Yarred and Panton [8] found carious teeth in seven cases out of ten children examined by them.

Rolleston [5] found carious teeth in his cases (all children), but not to a greater extent than in other children.

Many of my cases occurred in officers and men who scrupulously attended to their teeth, in fact, the frequency with which the gums were affected where the teeth had been well looked after was surprising. Irregular teeth, badly filled, capped and bridged teeth were most frequently attacked, but one never met the badly neglected mouth so frequently seen in the out-patient department of a general hospital.

A few cases (twelve) occurred after having teeth extracted or scaled by dentists; the gums of these patients may have been injured and thus allowed the organisms to gain a foothold and excite ulceration.

Infectivity.

The affections do not appear to be highly infectious.

Many cases of severely affected gums and Vincent's angina were treated in the general medical wards without any of the nursing staff or any of the other patients becoming affected.

Cases of direct infection have been reported by Peters [9], such as the hand becoming infected after striking a person in the mouth.

Hultgens [10] reports the case of a girl who infected her left index finger through biting her nails.

Small epidemics in children's homes have also been reported. Several of my cases prove the disease can be conveyed from one person to another. The following is a good example:—

Mrs. P., wife of Captain P., R.N., was referred to me for treatment for pyorrhœa. She said her gums had bled for three months. She consulted a dentist, who told her she had pyorrhœa and advised her to have her teeth extracted. To this her father, who was a Colonel in the I.M.S., objected. Her teeth were in perfect condition, but small ulcers could be seen at the tops of the papillæ between the teeth of the lower jaw and between the incisors of the upper jaw. The gums about these parts were separated from the teeth and bled when touched with a platinum loop. There were no pus pockets, no looseness of the teeth nor noticeable fœtor of breath. Smears from the gums examined microscopically showed many fuso-spirochætal organisms. Her father, who was present during the examination, suggested she might have caught the disease from a toy terrier she was in the habit of kissing and fondling; smears from the dog's gums, however, proved negative. While treating Mrs. P. she asked if I would examine her husband's gums as he was suffering from the same affection. He attended the next day, and I found his gums about the lower incisors ulcerated, tender, and bled from the slightest touch. Smears from his gums examined microscopically showed many fusiform bacilli and spirochætæ. He said he had been on leave from his ship for a month and his gums had bled for three weeks; he was quite sure he had caught the disease from his wife as he had never been troubled before with his gums.

Case 2.—Serjt. B., invalided from France—wounded in the thigh—was sent to me on account of a sore throat which had troubled him for a week. I found his left tonsil ulcerated, his breath fœtid, and his gums ulcerated and easily excited to bleed. He never complained of his gums, but when questioned about them, he said, "they had bled for about six months and now his wife was troubled in the same way." Smears from his gums showed many fusiform bacilli and spirochætæ.

As already stated, many cases came from barracks and billets where

they lived in close contact and liable to infect one another in several ways. Pte. S., Australian Post Services, living in billets with sixteen other men, three of whom were already under treatment for fuso-spirochætal ulceration of the gums, said he thought he caught his complaint a month ago through using by mistake a toothbrush of one of the men under treatment. I found a deep ulcer on his right tonsil which had pained him for three days, and his gums had been bleeding for three weeks. His disease was verified by the microscope. I also examined the tooth-brushes of the four affected men and found fusiform bacilli in all.

There can be no doubt that the disease can also be conveyed by the mouth-pieces of pipes, cigarette holders, gas masks, and other articles coming in contact with the mouth, and I have found fusiform bacilli in smears taken from the inside of mouth-pieces of pipes and cigarette holders. These modes of infection, however, account for only a few of the cases seen. Many of the cases came from their homes or billets removed from overcrowding and insanitary conditions, from whom no evidence of infection could be obtained.

The origin of the affections in these cases seems to find the best explanation in the frequency with which the exciting organisms are found leading a saprophytic life in what appear to be healthy mouths.

I examined microscopically smears from the throats of 1,320 healthy soldiers and found fuso-spirochætal organisms in thirty-two. I also examined smears from the gums of 230 healthy men who had not yet started military life and found no less than ninety-five positive. It thus looks as if these saprophytic organisms can under certain conditions become pathogenic [21].

The proportion of "healthy carriers" is highly significant. What the conditions in the life of the soldier are which stimulate these organisms into pathogenic activity I can offer no explanation. Neither can I see any explanation for the presumed greater prevalence of the affections among soldiers than among the civil population. The disease certainly is not allied to scurvy, nor can it be attributed to any want of fresh vegetables or fruit or dietetic errors. Tobacco smoking, mentioned by some as a contributing cause, does not offer any solution, as several cases occurred in non-smokers—*raræ aves* in the Army.

Exciting Cause.

"The affection is caused by an apparent association of a bacillus and spirochæte" [11]. The bacillus, first called by Vincent the fusiform bacillus, is straight or slightly curved and tapering at both ends. It is about four to twelve microns in length and about one micron in thickness.

Vincent, Weaver and Tunnicliff [12] state it to be non-motile, while others, including Abel [13] and Bernheim [14], assert it to be motile. My observations made in hanging drops of warm normal saline.

lead me to the conclusion that it is non-motile. The small amount of motility I have occasionally observed appeared to be due to small currents in the fluid.

According to Beitzke [15] flagella have been demonstrated by Graupner, and this observation has been confirmed by Muhlens.

The *Bacillus fusiformis* is easily stained by the basic aniline dyes, particularly weak carbolfuchsin. It is Gram-negative and anaerobic. In stained preparations vacuoles are often seen, and frequently spore-like bodies can be made out if a film is stained by warm carbolfuchsin and decolorized in one per cent sulphuric acid. Tunnicliff [30] states that "spores can be seen in the first days of a growth situated at one end or near the centre of the bacillus, and the development from the spore into the very short plump bacillus may be observed in a hanging drop."

The spirochæte is a delicate organism about twelve microns to thirty microns in length. It usually has five or six undulations of wide amplitude. It is quite distinct from the *Treponema pallidum*, which is finer, with eight, ten or more undulations.

The *Spirochæte vincenti*, as it is frequently called, is motile, and takes the stains like the fusiform bacillus. It is Gram-negative and anaerobic.

The fusiform bacillus and spirochæte may be easily displayed by the following simple procedure: A smear is made from a fuso-spirochætal ulcer, dried, fixed, stained for a few minutes in diluted carbolfuchsin, dried and examined under the oil immersion lens, when fusiform bacilli and spirochætæ will be seen usually in great profusion mixed up with cocci, bacilli, leptothrices, and other organisms.

Sometimes in severe cases almost pure cultures of fusiform bacilli and spirochætæ will be found, but these will gradually decrease in numbers as the process of recovery advances.

It should also be mentioned that some smears from a healthy mouth fixed, stained and examined microscopically, show quite a different picture from smears from a fuso-spirochætal ulcer of the gums, throat or mouth. In the former the fusiform bacilli, if present, are few and far between, while in the latter they are numerous.

Cultivations.

From the throats or gums of patients affected with fuso-spirochætal ulcerations the undermentioned culture media were inoculated: Serum agar (one in three), serum broth, broth, agar, Noguchi's kidney and broth medium, ordinary serum, nasgar and trypsin agar.

The following simple method was usually adopted: The test tube containing the medium was inoculated, the wool stopper pushed down the tube, on the top of this pyrogallic acid and liquor potassii were added, and a well-fitting india-rubber cap slipped over the mouth of the test tube, melted wax was then added over and around the cap and the test tube incubated at 37° C. for two, three, four or five days.

By the above method I obtained the best results from growing the *B. fusiformis* in serum broth and serum agar. The growths were always contaminated with cocci or streptococci or both, and all attempts to obtain a subculture failed. The colonies obtained on serum agar were small streptococcal looking but white. The media giving a growth of fusiform bacilli always had a very foul smell. Ellermann [16], Tunnicliff and Weaver [12] and others claim to have obtained pure growths of the fusiform bacillus on serum agar. In one tube of serum broth inoculated from a case of Vincent's angina I found two or three spirochætæ still active after four days' incubation at 37° C., but I was unable to decide whether there was a true growth. Muhlens and Hartmann [17] claim to have grown the spirochæte in pure culture, while Tunnicliff [30] states she has grown the spirochæte from the fusiform bacillus. Most observers, however, maintain they are entirely distinct organisms.

Helen P. Goodrich, D.Sc., and M. Moseley [31], in a paper recently published by them, describe a fusiform bacillus growing from a leptothrix forming what they call "bottle brush branches." These branches were only found on extracted teeth from advanced cases of pyorrhœa. It remains to be proved whether they are identical with the fusiform bacillus of Vincent's angina and allied affections. I find the above form of leptothrix was described as early as 1908 by Theo. von Beust [18].

Inoculations.

Ellermann [19] injected pure cultures into rabbits, and produced small abscesses. Hultgens [10] reports inoculations of pure growths into the peritoneal cavity of guinea-pigs, white rats and wild rats with negative results. The fusiform bacilli were recovered from the peritoneal fluid thirty days after inoculation but there was no sign of growth and no pathological conditions were visible in these animals.

Inoculations of the false membrane from cases of Vincent's angina beneath the skin or into the muscles of laboratory animals usually produce abscesses and ulcerating foci of necrosis in which the *B. fusiformis*, with many other organisms, are found [20].

Inoculation of fusiform bacilli and at the same time of 1 in 5 solution of lactic acid stimulate the formation of lesions and the growth of the bacillus [20].

Possibly the *B. fusiformis* requires ancillary organisms or damaged tissues like the *B. tetanus* before it produces its pathological effects, for inoculations of pure cultures of fusiform bacilli from whatever source are generally followed by negative results. Here it is interesting to recall the fact that twelve of my cases occurred after having teeth extracted or scaled by dentists.

Pathology.

Fuso-spirochætal affections of the mouth and throat are characterized by the formation of membranous ulcers which Vincent classified into two

types, both of which he fully described. I shall briefly mention their chief characteristics.

(*a*) The ulcero-membranous or deep type is by far the more frequent, and is found on the gums, tonsils, cheek, hard and soft palate and pillars of the fauces. It is usually covered by a thick, soft, creamy, membranous substance easily removed by a throat swab or any blunt instrument. The edges of the ulcer may be irregular or punched out, and the ulcer may extend deeply into the tissues or remain superficial. It has a red, angry look and bleeds under the slightest provocation, such as a light touch with a platinum loop.

Examined microscopically, the membranous exudate is seen to be composed chiefly of granular material in which may be seen a few leucocytes and many fusiform bacilli and spirochætæ and other organisms, as cocci, bacilli and leptothrices, in more or less abundance. Sometimes it presents an appearance of a pure culture of fusiform bacilli and spirochætæ.

(*b*) The superficial or diphtheroid type of ulcer—so called from its close resemblance to diphtheria—is characterized by the membrane covering the part being thin, white, or greyish-white in colour and very difficult to remove. If removed a red bleeding surface is left.

A smear from the membrane dried, fixed, stained with weak carbolfuchsin and microscopically examined, will be found to consist chiefly of fibrin, many fusiform bacilli and spirochætæ. If the membrane is hardened, sections cut, stained with carbolfuchsin and examined microscopically, it will be found to consist of a network of fibrin entangling a few leucocytes and fusiform bacilli often in closely packed clusters and sometimes forming a dense stratum through the section.

I shall describe the fuso-spirochætal affections of the buccal cavity and throat in the following order, taking those of the gums first because these are by far the most frequent, and, as far as my experience goes, always accompany and precede infection of the other parts invaded :—

(1) Affections of the gums.
(2) Affections of the tonsils (Vincent's angina).
(3) Affections of the mucous membrane of the buccal cavity.

Fuso-Spirochætal Affections of the Gums.

The gums are affected nearly three times more frequently than the tonsils. During the last twelve months I have attended over 350 cases. In all cases the ulcers conformed to the deep type—the soft membranous exudate was easily removed, leaving a bleeding surface. The form of ulceration most frequently met with is confined just to the tops of the gums as a thin narrow line around the necks of the teeth. The gums around one or many teeth may be involved. To this variety the name, "peridental ulcerative gingivitis" [28] has been given.

Sometimes the ulceration may affect only the tops of the papillæ between the teeth, at other times it may involve the surface of the gums

to the extent of a quarter of an inch (a typical ulcero-membranous type), or it may eat deeply into the gums and form deep excavations usually filled with a soft creamy exudate. The last form is common behind the lower molars, and occurred in forty-five of my cases. This form of ulceration frequently extends laterally, involving the cheek.

The gums are usually swollen, retracted, and separated from the teeth, and bleed under the slightest provocation. Sometimes the ulceration is so small, as in the peridental type, that it is very difficult to detect; its presence, however, can easily be revealed by lightly rubbing over the tops of the gums a small pledget of cotton wool, when small bleeding points will indicate the denuded parts.

Pain, bleeding, foul breath and nasty taste in the morning are usually complained of. There is as a rule no rise of temperature or constitutional disturbance. The pain may be so severe as to prevent mastication. The bleeding is most noticeable when the teeth are brushed. In many of the cases the patients were compelled to discard the toothbrush on account of the pain and bleeding excited.

The foul breath is somewhat characteristic but not always noticeable. When the ulceration is confined to the tops of the gums about the necks of the teeth (peridental type), the submaxillary lymphatic glands are not affected; but when the ulcers are deep and extensive I have always found the lymphatic glands enlarged and tender.

The ulceration may attack any part of the gums and extend along the whole of the upper and lower. The ulceration, however, is most frequently found about the necks of the lower incisors, the back molars, stopped or capped teeth, and at the tops of papillæ between irregular teeth.

Some cases develop in a few days and may involve the whole of the upper and lower gums (acute cases). The pain and bleeding in these are severe and call for early treatment.

Most cases are chronic and have been running for weeks, months or even years; in these the pain and bleeding are not so severe, but looseness of the teeth has been complained of. The peridental membrane was certainly affected in some of the chronic cases as radiographs showed considerable alveolar absorption. In one case of deep ulceration the dentist extracted a tooth, and smears from the apex of its root fixed, stained and microscopically examined showed fusiform bacilli. The root may, however, have become infected during extraction.

From my investigations there is every reason to believe that the so-called "trench gum" occurring among the soldiers in France is identical with this affection.

Several cases invalided home and diagnosed at the front as "trench gum" have been examined by me and found to present the typical clinical appearances, and the microscopic findings have always revealed the presence of the fusiform bacilli and spirochætæ in abundance.

Lieutenant D., invalided home two weeks ago, came for treatment on

account of a sore throat of three days' duration. He said during the last six months he was in France his gums were painful and bleeding and he was told he had "trench gum." I found a deep ulcer on his left tonsil and along the lower gums typical fuso-spirochætal ulceration. The submaxillary lymphatic glands about the left angle of the lower jaw were enlarged and painful.

Smears from the throat and gums showed microscopically many fusiform bacilli and spirochætæ. Many similar histories of cases might be recorded, but as they are practically reflections of the one given their repetition is unnecessary.

Diagnosis.—The only condition this disease is likely to be mistaken for is pyorrhœa alveolaris, and this diagnosis was made and the extraction of the teeth advised in many of my cases. The fuso-spirochætal affection is distinguished by the character of the ulceration, its liability to bleed, foul breath and pain. Moreover there are no pus pockets present as found in pyorrhœa alveolaris. Looseness of the teeth may be complained of and if an X-ray photo of the gums of these cases is taken, absorption and rarefaction of the alveolar border will most likely be found, but pus can never be squeezed up between the tooth and gum unless pyorrhœa alveolaris is also present.

The above mentioned clinical findings, corroborated microscopically by the finding of many fusiform bacilli and spirochætæ, complete the diagnosis.

Duration of the Disease.—Most of the cases under treatment get well in about three weeks, some in a shorter period; while a few—particularly those with irregular teeth, those where the disease has been present for a long period, and those wearing a dental plate, or where the disease cannot be regularly treated—run into months.

Complications.—The chief and most frequent complication is Vincent's angina, which was present in 157 cases out of 319. In three cases I have met with herpes labialis, and in one case red blood cells in the urine.

Relapses.—These are frequent if every trace of the disease has not been thoroughly eradicated. In a few, where smears from the gums have shown no trace of the fusiform bacillus, the disease has reappeared; but in the large majority, when the fusiform bacillus has been proved absent, the gums have remained free from any recurrence.

Treatment.—It is of the greatest importance to have the teeth well attended to. If necessary these must be thoroughly scaled and polished. It may not be possible to carry this out at first owing to the extreme tenderness of the gums. In such cases it is best to treat the gums for a few days with some antiseptic, when the tenderness will gradually lessen and permit the dentist to carry out the operation. Two or three sittings may be necessary to completely remove all tartar. I always insist on the frequent use of a mouth-wash such as peroxide of hydrogen or carbolic acid and chlorate of potash, particularly after meals, so as to wash away all particles of food. A soft toothbrush should be used if possible with an

antiseptic solution. The toothbrush should be kept in an antiseptic fluid when out of use, so as to keep it soft and clean, and thus prevent injury to the new tissues. When the gums are healed a new toothbrush should be obtained.

All cases should be informed of the infectious nature of the disease, and proper precautions taken to prevent it being transmitted to others by kissing, pipes, cigarette holders, etc. I always swab the gums daily or twice daily with an antiseptic. Among other things tried are tincture of iodine, colloidal iodine, colloidal silver, bacterol, flavine, and a mixture of vinum ipecacuanha ʒss, glycerine ʒi, liquor arsenicalis ad ʒi; but none gave such good results as an alkaline salvarsan solution double the strength ordinarily used for intravenous injections. This remedy was tried owing to the success attending its use in Vincent's angina. In this affection the salvarsan powder was simply dusted on the part by some, others swabbed it on mixed with glycerine. Ehrlich [26] tried salvarsan intravenously, but Citrol [27], who used both the local and intravenous methods, thought the former more efficacious. Before each swabbing I carefully dry the gums with cotton wool and pick out all extraneous matter from between the teeth with a dentist's probe.

The above treatment is continued daily or twice daily until smears from the gums show no fusiform bacilli and every niche and corner of the gums after careful examination show no bleeding points. No case should be discharged as cured until all traces of the disease have been eradicated. In no case has it been found necessary to extract the teeth to attain this end.

The following cases illustrate the characteristics of the affection :—

August 15, 1916. Lieut. C. R. F. Br., was sent to me by Sir F. F., on account of sore gums. There was a deep ulcer involving the gum behind the right lower wisdom tooth and extending superficially over the gum and right up the cheek over an area of the latter for about one square inch. The deep ulcer behind the molar was filled with a soft creamy exudation and the rest of the ulcerated patch covered with a thin greyish membrane. The tops of the upper and lower gums were also ulcerated and over these parts was a thin greyish exudate easily removed. The teeth were complete and in good condition. He said his mouth had been sore and bleeding since the beginning of June, 1916, and from that time up to the present he has been treated by ionization, paints, mouth washes, etc. The ionization gave him quick relief, but when this was discontinued for a few days the soreness of the mouth returned. The lymphatic glands at the angles of the jaw were enlarged and tender. His breath was very offensive. The ulcerated parts bled freely when lightly touched. Smears from the cheek and gums fixed, stained with dilute carbolfuchsin and microscopically examined showed fusiform bacilli and spirochætæ in abundance.

Urine.—No albumin. Few red blood cells.

Treatment.—Ulcerated parts were dried with cotton wool, and then lightly swabbed over with salvarsan solution. A mouth-wash of liq.

hydrarg. perchlor., pot. chlor. and glycerine was prescribed to be used frequently. The swabbing caused great pain and bleeding. August 16, 1916: The ulcerated parts were still covered with a greyish membrane, but the patch on the cheek appeared smaller. A small ulcer was now observed behind the left lower molar. The ulcerated parts were freely swabbed twice to-day. August 17, 1916: Patient said his mouth was much more comfortable. The swabbing still caused much pain and bleeding. August 18, 1916: Breath not so offensive. The ulceration on the cheek decidedly smaller. Mouth not so tender when painted. August 19, 1916: Mouth feels very much better. The ulcer on the cheek is now red and free from membrane, and so were several parts of the gums. The tenderness was much less when parts were swabbed. August 20, 1916: Gums improving, but still bleed freely when swabbed. August 24, 1916: Gums swabbed with one per cent solution of flavine. August 30, 1916: Gums have continued to improve. Flavine solution has been freely applied each day. Most of the ulceration is healed, but small tender, bleeding ulcers still remain in several spots between the upper molars and lower incisors. Urine free from red blood cells. August 31, 1916: Gums to-day show no improvement, so they were swabbed with a mixture of arsenic, vin. ipecac. and glycerine. This treatment was continued daily till October 2, 1916, when there still remained a small ulcer at the top of the gum between the lower canine and left second incisor.

At this date the officer was ordered to rejoin his unit.

Smears were taken and examined on many occasions during his attendance, and always found positive. On the date he was recalled very few fusiform bacilli could be found. The ulceration in this case was severe and intractable, and the treatment not so successful as in most cases. I have no doubt, unless his gums are regularly treated, the disease will quickly relapse.

November 4, 1916: Captain H. came for treatment; he said he had been troubled with sore and bleeding gums for eight weeks. A dentist he consulted told him he had pyorrhœa, and he must have his teeth extracted. To this he objected, so the dentist tried treating his gums with carbolic acid and tincture of iodine. After the effects of these applications had passed off he found his gums as bad as ever. His teeth were in good condition. The two left lower bicuspids were stopped with gold and the first upper right molar gold capped. The tops of the gums about these teeth were ulcerated, and there was a deep ulcer filled with a soft, creamy exudate behind the left lower wisdom tooth, and there was peridental gingivitis about the necks of the lower central incisors. The lymphatic glands about the left angle of the jaw were enlarged and tender. Smears from the ulcerated parts examined microscopically showed many fusiform bacilli and spirochætæ. Urine normal. A mouth-wash of peroxide of hydrogen was ordered to be used frequently. The usual instructions given concerning the toothbrush, and the gums dried and then swabbed with

salvarsan solution. November 20, 1916: Ulcer behind lower wisdom tooth quite healed, only a small bleeding spot on the top of the papilla between the lower central incisors to be found. November 24, 1916: Treatment carried on till to-day when gums were quite healed, and no fusiform bacilli could be found microscopically.

The first case is a good example of a type occasionally met with which run a chronic and refractory course, and this case moreover is the only one in which I met with red blood cells in the urine.

Fuso-spirochætal Affections on the Tonsils, so-called Vincent's Angina.

Vincent's angina in my series of 157 cases was always accompanied with fuso-spirochætal ulceration of the gums. In the majority of cases the form of ulceration affecting the gums was of the peridental type; in the remainder the ulceration was more extensive (typically ulcero-membranous).

In not a single case of Vincent's angina have I failed to find the gums affected, and what is more, almost every case on inquiry disclosed the fact that the gums were affected prior to the tonsils, and it certainly appeared

Chart 2.

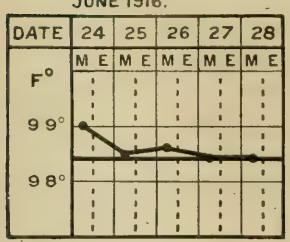


Chart 3.

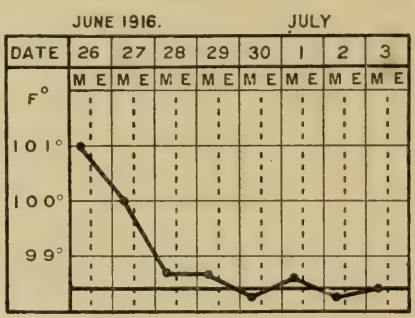
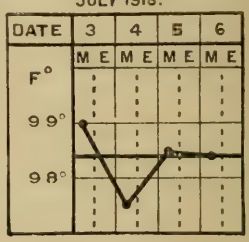


Chart 4.



as if the tonsils became infected from the gums. Moreover this sequence of events is supported by many cases (twenty) where the gums remained unhealed and the tonsils became re-infected and ulcerated.

Further it is interesting to recall that the rise and fall of the numbers of cases of Vincent's angina met with during the year 1916 were synchronous with those of the gums.

Symptoms.—The patient rarely looks or feels ill. He usually complains of pain or discomfort in the throat increased on swallowing, occasionally darting up to the ears. He may have headache and indefinite pains in the limbs. The temperature very rarely exceeds 100° F., and when raised usually subsides in a day or two. The pulse-rate simply shows the usual relationship of fluctuations to temperature. The small amount of constitutional disturbance found is surprising, and forms a strong point

in the diagnosis of the affection. The lymphatic glands about the affected region are enlarged and tender. As a rule the mouth can be easily opened, when the hard and soft palate will often be seen to be red or injected. If the tonsils are examined one of two conditions will usually be found.

(*a*) On the surface of one or both tonsils will be seen a soft whitish creamy-looking membrane which can easily be removed with a swab, leaving behind a deep ragged or punched-out ulcer with a bleeding base. This is the deep type of ulcer.

(*b*) Or you will find a thin whitish membrane covering part or both tonsils, very difficult or impossible to remove by gentle brushing, but if removed leaving a bleeding ulcer. This is the diphtheroid or superficial type of ulcer.

In 150 cases I found the right tonsil affected in 66 cases: left tonsil affected in 36 cases; both tonsils affected in 48 cases. In 150 cases I found 120 cases the ulcers were of the deep type; 30 cases the ulcers were of the diphtheroid type.

The membrane if removed is found to have a very foul smell, and the same fœtor is noticeable about the breath of the patient.

Some ulcers are very acute and may extend rapidly in surface and depth. I have seen an ulcer increase half an inch in depth in twenty-four hours. The diphtheroid or superficial ulcer may cover both tonsils, pillars of fauces and soft palate presenting an appearance very like diphtheria and frequently mistaken for it. The deep ulcer may similarly encroach on the parts adjoining the tonsils.

The urine is usually normal.

In six of my cases albuminuria was present, and in eleven, including the above six, red blood cells were found. Renal casts were found in one case.

The Blood.—In a few cases, particularly where the temperature was raised, there was an increase in polymorphonuclears. In about ten per cent of the cases examined I found an increase of hyalines, occasionally reaching twenty-one per cent in a differential count, which fact is interesting considering the protozoon present in the infection.

Duration of Disease.—Most of the cases recover in ten or eleven days. The average duration of 150 cases was fifteen days. Ulcers of the deep or ulcero-membranous type tend to recover more quickly than the diphtheroid or superficial type.

The affections of the throat and soft parts of buccal cavity nearly always recover more quickly than the gums.

Complications.—The chief and most important is ulceration of the gums. This as already stated was found in every case, and as the tonsil most likely becomes infected from the gums the importance of recognizing the connexion must always be borne in mind in carrying out treatment. For unless the disease is thoroughly eradicated from the gums the affection is likely to reappear in the tonsil. Many of the cases attended gave

histories of recurrent sore throat, and the tonsils of some of the cases presented a pitted, ragged appearance, bearing testimony to their statements. As already mentioned, albumin, red blood cells, and tube casts have been found in the urine. Klebs-Löffler bacillus was found co-existing in eleven cases, syphilis in two—both cases corroborated by positive Wassermann reactions.

Sequelæ.—The only sequela met with following the disease was slight general weakness.

Recurrence.—The affection recurred in twenty cases, and there were reasons to believe the re-infection of the throat in every case was due to fuso-spirochætal ulceration of the gums. The gum ulceration usually met with in these relapsing cases is of the peridental type, which, owing to the small amount of the gum affected, is liable to be easily overlooked.

Diagnosis.—In the majority of cases the diagnosis can be made with reasonable care from the clinical appearances alone, but to be on the safe side a direct smear should be fixed, stained with weak carbolfuchsin or methylene blue and examined under the high power ($\frac{1}{12}$) for fusiform bacilli and spirochætes. The presence of co-existing diphtheria and syphilis must never be lost sight of. From every one of my cases cultures were made on ox serum slopes and incubated at 37° C. for twenty-four hours and then examined for the Klebs-Löffler bacillus.

The chief clinical features of Vincent's angina are :—

(1) Slight constitutional disturbance.

(2) Temperature rarely over 100° F.

(3) Pain on swallowing.

(4) Submaxillary lymphatic glands enlarged and tender.

(5) Disease often unilateral.

(6) The membranous exudate is usually easily removed, leaving a raw bleeding surface.

(7) Urine rarely albuminous.

(8) Presence of fusiform bacilli and spirochætæ.

In diphtheria we have a membranous formation accompanied by :—

(1) Severe constitutional symptoms.

(2) Both sides of the throat affected (usually).

(3) Pain on swallowing not great.

(4) Submaxillary lymphatic glands not so tender.

(5) Membrane difficult to remove.

(6) Albumin frequently present in the urine.

(7) Klebs-Löffler bacillus present in culture.

Fusiform bacilli and spirochætæ may be found in syphilitic ulcers, but the ulcer has not the clinical features of the true Vincent's angina. The lymphatic glands are not enlarged and tender and a Wassermann reaction of the blood will settle the question.

The presence of positive Wassermann reactions apart from concomitant syphilis has been reported by Gerber [22], Much [23], Saverio [24], and Sobernheim [32].

In the case reported by Much the blood gave a positive reaction during the febrile period of the disease, but a fortnight later when the angina was cured the reaction was negative.

Sir StClair Thomson [25] writes: "From syphilis the diagnosis is more difficult, as both fusiform bacilli and spirilla may be found in a cover-glass preparation from a tertiary ulcer, and also because apart from concomitant syphilis the Wassermann reaction may be positive."

The Wassermann reaction of the blood was taken in thirty unpicked cases from my series, and was negative in all but two, both of whom admitted to having had chancres ten years ago.

From my uniform negative findings I can only conclude that latent syphilis must have been overlooked in those recorded cases giving a positive reaction, or the technique of the reaction was faulty. It is to be remembered the findings reported by Gerber, Much, Saverio and Sobernheim were made in the early days of the Wassermann reaction.

Here the following case, one of the two in which syphilis co-existed with Vincent's angina, is worth recording :—

December 14, 1916.—Pte. G., an Australian, attended the hospital suffering from a typical superficial ulceration of the right tonsil of one week's duration. His temperature was normal. His right submaxillary lymphatic glands were swollen, his breath fœtid, and his teeth dirty and tartrated. The gum lines along the upper and lower teeth were ulcerated and covered with a soft creamy exudate. Smears from the tonsil and gums suitably prepared and microscopically examined showed many fusiform bacilli and spirochætæ. He was first referred to the dentist to have his teeth scaled and polished. The ulcers were then treated and the tonsil healed in six days. He still continued to attend for treatment for his gums. December 24, 1916: An indolent-looking ulcer was noticed on his left tonsil, and smears prepared from this and microscopically examined showed a typical picture of Vincent's organisms. It was noticed, however, that the left submaxillary lymphatic glands were not enlarged or tender, and that the ulcer when touched did not bleed. On inquiry he admitted to a chancre ten years ago, and his blood gave a strong positive Wassermann reaction.

The diagnosis of Vincent's angina from the ordinary acute tonsillitis can usually be easily made from the severe constitutional symptoms accompanying the latter.

Treatment.—The local treatment applied to Vincent's angina is the same as that for the fuso-spirochætal affections of the gums, and as they are always co-existent this is easily carried out. There are, however, one or two obvious facts to be borne in mind, if there is a rise of temperature or albumin present in the urine the patient should be put to bed and a light milk diet ordered.

The precautions already laid down in "Treatment of the Gums" respecting the use of the toothbrush and the infectious nature of the disease must be carried out.

The following histories represent the types of cases met with :—

November 1, 1916. Pte. G. complained of sore throat of twenty-four hours' duration. Temperature normal ; pulse 70. The lymphatic glands at the left angle of the jaw were enlarged and tender and there was pain on swallowing. The left tonsil was covered with a thin greyish membrane easily removed, and there was a peridental ulceration along the tops of the gums about the necks of the lower incisors. His teeth were sound and in good condition, but he volunteered the statement, "his gums had bled badly for the last week when brushed." Touching the tonsil and gums with a platinum loop caused them to bleed. Smears from the tonsil and gums were fixed, stained and microscopically examined, and many fusiform bacilli and spirochætæ found. Urine normal.

Blood.—Red blood cells, 6,200,000 ; white blood cells, 7,125 ; polymorphs, 75 per cent ; small lymphocytes, 21 per cent ; large lymphocytes, 4 per cent. Wassermann reaction of the blood gave a negative result. Treatment was carried out on the lines already laid down and a salvarsan solution applied to the throat and gums. November 6, 1916 : Throat and gums have been treated daily up to date—both are much better—the tonsil almost well. A deep ulcer has appeared at the top of the left anterior pillar of the fauces. The sides of the ulcer are irregular and the tissues around are red and swollen. The ulcer was about half an inch deep, and filled with a soft creamy exudate. Smears from this showed many Vincent organisms. The same treatment was continued to all three ulcers and the throat and deep ulcer on pillar of fauces were healed by November 6, 1916. The gums, however, were not healed and free from fusiform bacilli until December 5, 1916.

July 3, 1916 : Lieutenant D. complained of sore throat, increased on swallowing and headache. His face was flushed. Temperature 99° F. Pulse 80. The lymphatic glands about the right angle of the jaw were enlarged and tender. He opened his mouth without any difficulty, and on the top of the right tonsil a whitish patch could be seen which was easily removed by a platinum loop, leaving a deep ragged bleeding ulcer. The teeth were in good condition, but the tops of the gums about the lower incisors and right upper molars were ulcerated. *Blood :* White blood cells, 4,575 in one cubic millimetre. *Differential Count :* Polymorphs, 73 per cent ; hyaline, 11 per cent ; lymphocytes, 16 per cent. The urine contained a trace of albumin and a few red blood cells. Smears from the right tonsil and gums contained many Vincent organisms. A gargle and mouth-wash of peroxide of hydrogen was ordered to be used frequently, and the gums gently dried and swabbed over with salvarsan solution. July 4, 1916 : Pain on swallowing less. Flushed appearance gone. Temperature 97° F. Pulse 72. Exudate over the tonsil had reformed. Treatment continued. July 5, 1916 : Pain in throat gone. Submaxillary glands almost painless to touch. Exudate over ulcer of tonsil reformed, but was much smaller. Smears showed fewer fusiform bacilli and spirochætæ.

Urine: Albumin 0·2 per cent. Few red blood cells and few hyaline casts. July 6, 1916: Patient says he feels well. Temperature 98·6° F. Pulse 70. Patch on right tonsil smaller. *Urine:* No albumin; no casts; few red blood cells. July 7, 1916: Temperature 98·6° F. Ulcer on tonsil almost healed; no white patch to be seen. Lymphatic glands about angle of jaw can only be felt with difficulty. *Urine:* 0·5 per cent albumin; no casts; few red blood cells. July 8, 1916: Ulcer on tonsil healed. *Urine:* No albumin; no casts; few red blood cells. July 9, 1916: The gums had been treated daily and were now much better. *Urine:* No albumin; no casts; no red blood cells.

The progress continued and the gums were treated till July 16, 1916, when smears from them showed when examined microscopically no fusiform bacilli.

The above recorded cases reflect, except in a few minor and unimportant details, the rest of the cases met with. The same sequence of events is repeated time after time, first the sore and ulcerated gums, followed by ulceration of the tonsils.

To some the ulceration of their gums was unknown and had to be sought, others knew of the pain and bleeding but thought them not worth mentioning, while in many the ulceration was too painful and inconvenient to be ignored. So far I have not met a single case of Vincent's angina where the gums have been found free from fuso-spirochætal ulceration.

Fuso-Spirochætal Affections of the Mucous Membrane of the Buccal or Mouth Cavity.

Fuso-spirillary ulcerations of the mucous membrane of the mouth cavity are rare compared with the frequency they affect the tonsils and gums. During the year 1916 I only met with seven cases where the ulceration was not continuous with a similar ulceration of the tonsils or gums.

In every one of those cases there co-existed ulceration of the gums, and the histories when obtainable repeated the sequence found in Vincent's angina, namely, that the gums were affected prior to the mucous membrane. The parts of the mucous membrane mostly affected were, in the order of their frequency, soft and hard palate, anterior pillars of the fauces and cheek about the buccal space opposite the molars. I have never met with any fuso-spirochætal ulceration of the tongue.

The ulcers may be deep or diphtheroid; the former variety is certainly the more common, but ulcerations of the diphtheroid type occur more frequently than on the tonsil. In my seven cases two were diphtheroid and five of the deep or ulcero-membranous type.

Sometimes the ulcers remain small and deep and tend to perforate the part, or they may extend over large areas and involve the hard and soft palate or an extensive part of the cheek. I have never met with an

ulceration with the clinical appearannce of noma. The signs and symptoms of the affection in these parts are as characteristic as when the tonsils are affected. There is very little constitutional disturbance, but there is fœtor of breath, pain, great tenderness and membranous formation over an area easily excited to bleed. The lymphatic glands are usually enlarged and tender. The physical appearances of the affected part often suggest diphtheria or syphilis. The course, duration, complications and sequelæ are the same as found in the tonsillar affection. The histories of a few cases will make these points clear.

July 13, 1916 : Captain S., a Canadian, complained of headache, sore throat, and feeling ill. Temperature, 99·4° F.; pulse, 60. Lymphatic glands about the right angle of jaw were swollen and tender. There was a thin greyish membrane about the size of a halfpenny over the right side of the soft and hard palate and the parts about the membrane were red, swollen, and sodden looking. The membrane could not be removed by lightly brushing with a swab. There was peridental ulceration of some weeks' standing about the lower incisors. The tonsils were not affected. Smears from the membrane on the palate and from the gums, fixed, stained and microscopically examined showed many fusiform bacilli and spirochætæ. Cultures were also made on ox serum and incubated at 37° C. for twenty-four hours. The urine was free from albumin but contained a few red cells. A blood count showed nothing abnormal. A mouth-wash of peroxide of hydrogen was ordered to be used frequently, and the palate and gums were freely swabbed with salvarsan solution. July 14, 1916 : No Klebs-Löffler bacillus found on ox serum growth. Temperature 98·6° F. Patient says he feels worse. The palate looks much the same, but the tissues around the membrane are not so swollen. A deep ulcer has now formed on the gum behind the right lower wisdom tooth. Treatment continued. July 15, 1916 : Patient complains of great pain in the mouth, and will not allow any swabbing. The palate and gums appeared very much the same except a small black slough had formed over the soft palate. Temperature to-night rose to 101·2° F., and as he complained of pain and sleeplessness morphia $\frac{1}{4}$ grain was given subcutaneously. Urine: No albumin ; a few red blood cells. July 16, 1916 : The membrane on the palate is larger. Patient says he feels a little better. Temperature 99·2° F. July 17, 1916 : Patient feels a little better. Mouth looks much the same ; still too tender for swabbing. July 18, 1916 : Patient feels very much worse, so he was seen in consultation with Mr. Potter, laryngologist, and Colonel Pasteur, F.R.C.P. ; the former expressed the opinion that the mouth condition was most likely specific. Blood taken for Wassermann reaction, and he was afterwards given a mixture of liq. hydrarg. perchlor. and pot. iod., and the mouth-wash changed for one of liq. hydrarg. and pot. chlor. July 19, 1916 : Wassermann reaction negative. Patient much the same. July 20, 1916 : The membrane on palate is separating. Patient says he feels better. Swabbing the gums and palate with salvarsan solution resumed. Smears

from palate show many fusiform bacilli and spirilla. July 21, 1916: The palate is almost clear of membrane and ulcer is beginning to heal. Patient very much better. From this date he made a steady and rapid progress, and was discharged on July 30, 1916, when the fusiform bacilli were found in smears from the gums. The gums were several days healing after the palate had recovered.

Finally, I quote the following case—although incomplete in many details—because of its rarity, treatment and sequelæ, and more particularly because it embodies a few points mentioned by previous writers on Vincent's angina, but as yet untouched by me.

Nurse A. was taken ill at King George Hospital, on August 7, 1916, and the following short report was sent by the medical officer of that institution, when she was transferred to an auxiliary hospital of Queen Alexandra's Military Hospital.

"Nurse A. complained of sore throat. Temperature, 101·4° F.; pulse, 120. Left tonsil inflamed and covered with a thick whitish-yellow membrane. Patient looked ill. Swab taken from the throat. She was put to bed, ordered calomel grains 2½ and mixture of liq. hydrarg. perchlor., gargles and foments. 10.30 a.m., August 8, 1916: Throat looking much worse. Membrane extended and greyish-dark in colour, uvula and tissue between uvula and left tonsil infiltrated. Swab-growth from serum showed few rods and cocci. No Klebs-Löffler bacillus. Treatment continued. Diphtheria antitoxin 12,000 units given as a precaution. 5 p.m.: Patient looking worse. Membrane darker in colour and more extensive. Condition regarded as severe infection—probably septic—exact organism not known. Has been nursing patient with similar throat who died August 6, 1916. She was now transferred to Vincent Square Hospital, where I was asked to see her and examine swabs from her throat. On admission her throat was found as described: Palate and uvula very swollen and infiltrated and covered with a large black-looking slough; her breath was very offensive and the submaxillary glands enlarged, painful and tender. Temperature, 103° F.; pulse 108. Ordered antiseptic gargles and inhalations. August 9: Passed a fair night and seems a little better. Direct swabs show a mixed infection of Vincent's organisms and many streptococci. Ox serum growths produced no Klebs-Löffler bacillus.

"On the advice of Captain McKinstry, who examined the patient and swabs, a gargle of liq. hydrarg. perchlor. and pot. chlor. with glycerine; mixture of tinct. ferri perchlor., and a subcutaneous injection of 100 millions of sensitized streptococcal vaccine were ordered.

"August 10: Improved; much less œdema in throat. Slough separating. 250 millions of sensitized streptococcal vaccine given subcutaneously. August 11: Patient passed a good night and is much more comfortable. Œdema and swelling greatly lessened; slough coming away. 500 millions of sensitized streptococcal vaccine given. August 12: Patient much improved. 1,000 millions sensitized streptococcal vaccine given. August 13:

Patient very much improved and most of the slough has come away. Urine, albuminous and shows microscopically epithelial, hyaline and granular casts and red blood cells. September 8: Patient continued to improve and was able to take short walks. To-day she complained of difficulty of swallowing. Paralysis of the ciliary and palatal muscles was found. Patient put back to bed. Swabs again taken from the throat. Smears were stained and microscopically examined; no Vincent's organisms found. Serum cultures were made and incubated at 37° C. for twenty-four hours. No Klebs-Löffler bacillus found. September 25: Palatal paralysis has gradually increased. Voice nasal and speech slurred. There is now slight paresis of hands and feet; loss of sensation to touch and pain in both feet and numbness of fingers; knee and plantar reflexes absent. September 26: Seen to-day by Colonel Pasteur, F.R.C.P., who confirmed the above condition and ordered a mixture of liq. strych. hydro. ch. ♏ v, tinct. bellad. ♏ x every four hours. December 25: Convalescence has been gradual and uninterrupted. All paresis, motor and sensory, is now gone. Urine shows only a trace of albumin; no casts. Patient sent to a convalescent home."

The smears from this case in the early part of the disease showed Vincent's organisms, but the picture of the films was not the one usually obtained from Vincent's angina, the fusiform bacilli were few and far between, and the line of treatment pursued was suggested by the abundance of streptococci present.

Paralysis of the ciliary and palatal muscles, loss of knee-jerks and ataxia have been recorded following infections of Vincent's organisms.

In the series of my cases I have not met with any nerve complication or nerve sequela. The paralyses following the acute course of the above case at once suggest diphtheria, but ox serum smears were made, incubated and examined by me and others with negative results.

Osler [29] writes: "Occasionally paralyses follow streptococcus tonsillitis which are identical with those of diphtheria"; and I think from the success which followed the administration of the sensitized streptococcal vaccine in the above case we are justified in concluding it a streptococal infection. The high temperature and severe constitutional disturbance were in themselves sufficient to separate it from Vincent's angina. Moreover after reviewing all my cases I cannot help feeling sceptical concerning the recorded cases of paralyses following a true Vincent's angina. The co-existence of diphtheria and Vincent's organisms, which has already been referred to, might be easily overlooked, but not more easily than associated streptococcal infection.

In conclusion I should like to state that the diagnoses of all my cases have been confirmed microscopically, and also the fact that ox serum inoculations were made, incubated for twenty-four hours and afterwards examined microscopically for Klebs-Löffler bacillus.

The points I have attempted to bring out in this communication may be epitomized under three heads.

(1) The different varieties of fuso-spirochætal ulcerations of the gums.

(2) The invariable association of fuso-spirochætal ulceration of the gums with Vincent's angina and allied affections of the mouth cavity.

(3) Vincent's angina and the allied ulcerations of the mouth cavity are always secondary to fuso-spirochætal ulceration of the gums.

REFERENCES.

[1] Babes. *Deutsch. med. Wochenschr.*, 1893, Nr. 43.
[2] Miller. *Ibid.*, 1888, Nr. 30.
[3] Plaut. *Ibid.*, 1894, Nr. 49.
[4] Vincent. *Ann. de l'Inst. Past.*, 1896, 1899. "Sur une forme particulière d'angina diphtheroid," *Soc. med. des Hóp.*, March 17, 1898. "Nouvelles recherches sur l'angine à bac. fusiform," *ibid.*, January 12, 1899.
[5] Rolleston, J. D. *Brit. Journ. Children's Dis.*, July, 1910, p. 299.
[6] Bruce, H. W. *Lancet*, 1904, p. 135.
[7] Halsted. "Vincent's Angina." *Laryngoscope*, xxii, 1912, p. 1377.
[8] Harwood-Yarred and Panton, P. N. *Lancet*, February 17, 1906.
[9] Peters. *Journ. Infect. Dis.*, 1911.
[10] Hultgens. *Journ. Amer. Med. Assoc.*, 1910, p. 857.
[11] Hewlett. "Manual of Bacteriology," sixth edition.
[12] Weaver and Tunnicliff, Ruth. *Journ. Infect. Dis.*, vol. ii, 1905.
[13] Abel. *Cent. f. Bakt.*, 1 Abt., Orig., Bd. xxiv, 1898.
[14] Bernheim. *Ibid.*, 1 Abt., Orig., Bd. xxiii, 1898.
[15] Beitzke. *Ibid.*, Ref., Bd. xxxv, 1904.
[16] Ellermann. *Ibid.*, 1 Abt., Orig., 1904, Bd. xxxvii, p. 729.
[17] Muhlens and Hartmann. *Zeitschr. f. Hyg.*, 1906, p. 81.
[18] von Beust, Théo. *Berl. klin. Wochenschr.*, November, 1909, p. 2058.
[19] Ellermann. *Cent. f. Bakt.*, 1 Abt., Orig., 1905, Bd. xxxviii, p. 383.
[20] Bisson. "Practical Bacteriology, Microbiology and Serum Therapy."
[21] Hess. Epitome, *Brit. Med. Journ.*, January, 1904.
[22] Gerber. *Deutsch. med. Wochenschr.*, 1910, Bd. xxxiv, p. 2385.
[23] Much. *Med. klin.*, 1908, Bd. iv, p. 1119.
[24] Saverio. *Arch. ital. di otol., rinol. et laryngol.*, 1910, vol. xxi, p. 177.
[25] Thomson, Sir StClair. "Diseases of Nose and Throat," second edition, 1916, p. 415.
[26] Ehrlich. *Münch. med. Wochenschr.*, 1910, Bd. lvii, p. 2268.
[27] Citrol. *Berl. klin. Wochenschr.*, 1913, Bd. l, p. 627.
[28] Taylor and McKinstry. *Proc. Roy. Soc. Med.*, January, 1917.
[29] Osler. "Principles and Practice of Medicine," eighth edition, p. 381.
[30] Tunnicliff, Ruth. *Journ. Infect. Dis.*, 1911, vol. viii, p. 321.
[31] Goodrich, Helen P., and Moseley, M. *Journ. Roy. Microscop. Soc.*, January, 1917.
[32] Sobernheim. *Arch. f. Laryngol.*, 1909, Bd. xxi, p. 504.

NOTES ON A SERIES OF CASES OF GUNSHOT WOUNDS DURING THE CAMPAIGN IN EAST AFRICA.

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In putting on record these cases of gunshot wounds occurring during the campaign in East Africa the authors do not lay claim to any particular originality, but do so with the object of illustrating the types, treatment and progress of wounds occurring in a country never previously fought over by white troops. It must be borne in mind that in such a country where the distances to be travelled from the fighting area to the base are very great, the methods of transport unavoidably slow owing to the rough nature of the country, and the opportunities for frequent dressings of wounds difficult, the conditions under which wounds are treated and their subsequent progress must of necessity be considerably different to those prevailing in more civilized countries such as Europe.

In none of the cases recorded were the wounds seen at the General Hospital, Nairobi, in less than three days from their infliction, and during this time the only dressing applied was the first field dressing. The reason for this delay in transport is that the only method of evacuation is by a single line (the Uganda Railway) which must of course deal primarily with the demands of the fighting area. Owing to the satisfactory condition of the wounded and of their wounds it was thought inadvisable on surgical grounds to change the dressings in the train except in a few cases, viz., shell wounds (not dealt with in this paper).

The type of country in which these wounds were received was that of dense bush, sparsely populated by man and beast, entirely uncultivated and of a malarial nature.

When considering the progress of the wounds, it is of interest to note that the wounded men in our cases had all been serving in tropical climates for several years and few had escaped malaria at one period or another. The bullets inflicting the wounds varied in calibre from 0·303 to 0·450, both rifle and machine-gun. The ranges also varied considerably from 700 yards to 15 feet.

The General Hospital, Nairobi, where treatment was carried out, is situated about 6,000 feet above the sea-level and in an equable and exceptionally healthy climate for a tropical country. We have found the method of case taking, below tabulated, invaluable in the cases of gunshot wounds admitted to our hospital.

(1) Date of wound.....
(2) Place where wounded.....
(3) Position the man was in when wounded.....
(4) Range at which wound was received.....
(5) Variety of missile .....
(6) The number of times dressed before reaching hospital .....
(7) The date of admission to hospital.....
(8) Entrance wound—
  (1) Where: (*a*) Position .....
    (*b*) Proximity to vital parts.....
  (2) Size .....
  (3) Character: (*a*) Shape .. ..
    (*b*) Presence or absence of sepsis.....
(9) Exit—
  (1) Where: (*a*) Position .....
    (*b*) Proximity to vital parts.....
  (2) Size .....
  (3) Character: (*a*) Shape.....
    (*b*) Presence or absence of sepsis.....
  (4) Relation to entrance wound.....
(10) Pain: character—
  (1) When: (*a*) Day ..... (*b*) Night .....
  (2) Where.....
(11) Position of bullet as shown by X-rays .....
(12) Treatment—
  (1) Operation: (*a*) Difficulties .....
  (2) Movements.....
  (3) Dressings .....
(13) Mental aspect of patient .....

We have noticed in our series of cases that sepsis has been very slight and of a non-virulent type, in spite of the long distances travelled after receipt of injuries and the few dressings applied. The patients arrived in good condition and remained so during the whole of the treatment.

The Character of Wounds.

It is a generally recognized fact that wounds received at short ranges show an entrance and exit wound of a fairly uniform size unless marked resistance is encountered—such as bone.

Pte. A. R., wounded at 100 yards by rifle bullet 0·316 which entered the lower third of leg, passed through the muscles only, making an exit wound on the posterior side, showed a small entrance and exit of similar size; but in the case of Pte. C., of the ———, wounded at a range of fifteen feet by rifle bullet 0·303 there was a small entrance wound at the anterior surface upper third of the left trapezius and a large exit wound three inches by three inches in the region of the first and second dorsal spines (which had been struck). This is well shown in fig. 1 taken seventeen days after receipt of wound. This case also illustrates the fact that a bullet striking a bone obliquely produces a much larger exit wound than when it hits bone at a right angle.

The entrance wounds in all cases have been oval or circular and not larger than a threepenny piece, the edges have not been noticeably inverted

but more or less flush with the surface; sepsis, as before noted, was slight. The wounds have been mostly on the head, neck and extremities, i.e., the most exposed parts in bush fighting. Wounds of the abdomen are rare. It has been remarkable in our cases the extent to which main vessels have escaped injury, though nerves have frequently been involved.

Fig. 1.—Seventeen days after receiving wound.

Position when Wounded.

We have found it very instructive to elicit from the patient the exact position he was in when struck and have noted the following points :—

(1) If skin is tense, the bullet generally passes right through.

(2) If skin is slack at time of receipt of injury, the bullet generally lodges.

(3) Difference between exit and entrance wounds.

The cases cited below are examples of the above points.

Case 21.—Lance-Cpl. H. J., aged 25 years, Royal Fusiliers, was wounded at 300 yards range by a machine-gun bullet while in the act of firing. The bullet struck his right forearm, four inches below olecranon, on the upper surface, passing under the cellular tissue, lacerating the bicipital fascia, bursting open the skin in the fold of the elbow, passing onwards under the skin and making an exit in the middle of the upper arm on the inner side, pushing some of the biceps muscle with it.

Case 14.—Pte. E. L., Royal Fusiliers, was wounded at a range of 600 yards by a rifle bullet while lying on his back with his left extremity drawn up and his right crossing over it. Bullet entered at inner side of left thigh at junction of lower third with upper two-thirds (top of Hunter's

canal), passing downwards and outwards through the muscles, finally lodging just underneath tensor fasciæ femoris one inch lower down than level of entrance wound.

Case 33.—Pte. J. O., aged 24 years, Machine-gun Company, was wounded at 700 yards range by machine-gun fire while advancing—his body upright and his left leg being forward at the time he was struck. The bullet struck his right buttock making a gutter wound about four inches in length, passing onwards enucleating the left testicle and cord out of the left side of the scrotum, and then grooved the inner side of left thigh close up to the groin for about four inches in extent, in a similar manner as the wound in the right buttock. It was quite impossible to determine

Fig. 2.

which was the entrance and which was the exit wound, until he was questioned as to the position he was in when hit. The left testicle hanging lower than the right also helped in elucidating the direction. Other interesting points in this case were the absence of pain in the left testicle, with final atrophy of the testicle and withdrawal of remainder into scrotum by the dartos and cremasteric muscles without any surgical interference of a plastic nature (see fig. 2).

Injury to Nerves.

This had been the commonest complication in our series of cases. Temporary paralysis, peripheral neuritis and paresis have resulted in many cases from concussion effects to the nerves, hæmorrhage round a nerve with resultant pressure, and in one case direct lodgment of the casing of a bullet in the nerve itself. Absence of pain has often been found to be due

to division of cutaneous nerves, and in connexion with this we have noted one case where temporary paralysis (functional) was produced.

Pte. G. D., Machine-gun Company, was wounded by rifle bullet at 100 yards range. The bullet entered above left clavicle about the middle, making an exit above centre of spine of scapula. Fourteen days after discharge from the surgical section he was referred to us for further treatment, having developed complete paresis of the left arm. Careful examination was made, and no cause could be ascertained. The patient was told that the nerves were not damaged, and he made a rapid and complete recovery.

Case 28 (illustrating paresis from hæmorrhage around nerves).—Cpl. C. B., aged 30, Machine-gun Company, was wounded on March 11, 1916, while lying down facing the enemy. The bullet (rifle) entered just below the middle third of the left clavicle. No exit wound evident. X-ray photos, taken on several occasions, of the whole of chest and left arm failed to show bullet. There was, on admission March 14, 1916, some difficulty in raising the left arm, and severe pain—worse at night. On March 23, 1916, wrist drop was noticed, also flabbiness of all forearm muscles. On March 24, 1916, a large ecchymosis appeared on the chest wall, and the biceps was paretic.

Recovery of a group of muscles was always preceded by severe pain. On May 16, 1916, patient could raise the arm above the head. From now onwards progress was steady towards complete recovery.

Case 18 (illustrating lodgment of bullet in nerve substance with recovery after removal).—Pte. J. M., aged 27, Loyal North Lancs., was struck on January 20, 1916, by a piece of casing, the result of an explosion of a belt of cartridges which was lying close to a fire. The wound was situated at the junction of the upper with the middle third of right arm. Complete anæsthesia of the little and ring fingers of right hand was noticed on January 21, 1916. The wound was explored under chloroform but no foreign body was found. Patient was admitted to General Hospital, Nairobi, on January 21, 1916; the same condition of anæsthesia was present, no wasting, only tingling. Pain was evident on pressure over the wound. X-ray photograph showed a small piece of metal above, and internal to, wound. Owing to peculiar anæsthesia (not anatomical), massage was ordered, also aspirin for the pain. Eight days after admission he was transferred to a convalescent home. On March 12, 1916, he was again transferred to the surgical section on account of persistent pain in the arm, with anæsthesia as before, and commencing contraction of the two fingers.

On examination, a tumour about the size of a small marble could be felt just above, and internal to, the healed wound in the upper arm; it was very painful on manipulation and corresponded with the position of the metal as seen in the X-ray photograph. Operation was undertaken on April 8, 1916. The mass when exposed was found to be median nerve

with fibrous tissue binding together the ulnar nerve. A small piece of metal casing was removed from the substance of inner side of the median nerve close to the mass of fibrous tissue between the median and ulna. Recovery after operation was rapid and complete, all pain disappearing within twenty-four hours.

Case 25 (illustrating peripheral neuritis).—Cpl. R. P., aged 31, Rhodesian Regiment, received a flesh wound on March 11, 1916, by rifle bullet at fifty yards range, about two inches long, raising a flap of skin and exposing the subcutaneous tissues in the region of the sciatic nerve at the lower fold of right buttock. On admission, he complained of numbness of foot and knee and inability to flex ankle. X-ray photograph was negative. Plantar reflex absent. Knee-jerk active. On April 15, 1916, he walked with difficulty, throwing his right leg forward jerkedly. Progress was slow, but he has since made a complete recovery.

Mental Condition of Patient.

The knowledge by the patient of the presence of a lodged bullet often has a marked effect upon his progress. It is immaterial to the patient mentally whether the position of the bullet is one of danger or not. The fact that it is lodged produces aches and pains which disappear rapidly on extraction. This has influenced us in extracting bullets which we otherwise would have left alone. It has been noticed that, in cases where the bullet has passed clean through the tissue without injury to the bone or other structures, patients have developed mental phenomena producing well-defined deformity, such as torticollis and contractions around joints. Pain has been conspicuous by its absence, but in the rare cases where pain has been a marked feature in a case of lodged bullet, extraction has not caused such rapid relief as one would anticipate. This absence of pain, in our opinion, was probably due to the rarity of sepsis, excepting those cases where cutaneous nerves were divided.

Value of X-ray Photographs.

We have adopted as a routine practice the X-raying of every case of gunshot wound admitted to hospital. Although in many cases entrance and exit wounds have been well defined and the wound apparently only a simple flesh wound, X-rays have revealed pieces of casing of bullets.

Case 1.—Pte. J. R., aged 24, Rhodesian Regiment, wounded on March 4, 1916, by rifle bullet at fifty yards range, received two separate wounds in the region of the elbow, one passing through the skin over the olecranon, the other through the skin in front. Entrance and exit wound were well marked in both wounds. Patient was discharged on March 28, 1916, as fit for duty. On April 3, 1916, he was re-admitted on account of weakness in the arm and pain over the olecranon. Examination revealed a cone-shaped fibrous tumour over the olecranon. Tumour was about one inch across the base—movable and not fixed to the skin. An X-ray

photograph showed a piece of metal casing embedded in tumour. Removal was followed by rapid recovery. The tumour was gritty on section, suggesting osteogenetic changes. Unfortunately, the piece removed for microscopical examination was lost.

Indefinite Localization of Bullet.

It has been found inadvisable to attempt extraction of bullets without previously having had them definitely localized in two planes. This is especially of importance in such places as the extremities where the flattening of the tissues due to lying on the plate at the time of photographing produces a wrong impression as to depth and relation to bone.

It is also of great importance to have the photograph taken immediately or as soon as possible before operation.

Case 13.—Pte. J. J., aged 23, Loyal North Lancs., was admitted on February 15, 1916, having received a wound on February 12, 1916, by rifle bullet at an unknown range. On examination there was a small oval wound just above the left anterior superior iliac spine, but no exit. He complained of slight pain in the groin, and on February 19, 1916, it had travelled down the left thigh, which was not swollen. X-ray examination negative. The patient was discharged to a convalescent home on February 27, 1916, and was re-admitted on March 16, 1916, on account of persistence of swelling of leg and thigh, and severe pain in Scarpa's triangle. Under rest and evaporating lotions this rapidly disappeared. On March 22, 1916, X-ray with localizer showed bullet lying over the anatomical position of the left iliac vein. The œdema and pain could now be accounted for. Per rectum a tender spot could be felt in the position of the bullet, as shown by X-rays. Abdominal laparotomy was performed on March 25, 1916, but nothing resembling a bullet could be seen or felt except by bimanual examination, when an occasional suggestion of a bullet could be located in the cellular tissue behind the rectum. As it was thought inadvisable to proceed further owing to difficulty of reaching the bullet through abdominal incision, the wound was closed. On April 9, 1916, the left leg again became swollen, and X-ray photograph showed the bullet apparently lying just above symphysis pubis. On April 22, 1916, a final X-ray (before transfer to Wynberg, Cape Town), showed the bullet lying exactly over hip-joint cavity, i.e., between the rim of the acetabulum and head of femur. This case demonstrates how a bullet may move somewhat rapidly from one place to another, even when the patient is confined to bed, owing to the laxity of tissues behind the peritoneum following the course of the left iliac vessels and psoas muscle. In some cases it has only been after several X-ray photographs that the presence of a lodged bullet has been demonstrated, and in others it has not been ascertained at all, in spite of there being no exit wound and evidence of a lodged bullet such as paresis, fracture and hæmorrhage. Where there

is no exit wound an area in close proximity to the entrance wound on either side should be examined by X-rays.

Case 8.—Serjt. J. P., aged 34, Rhodesian Regiment, received a wound on the outer side of the right leg about three inches below the knee, at 300 yards range by rifle bullet. There was no exit wound—X-ray showed a spiral fracture at the middle of tibia, but no bullet. Several subsequent photographs failed to show any trace of a foreign body.

Effects of Lodged Bullets.

Besides the mental effects produced by the knowledge of a lodged bullet already described, definite physical effects have been observed, viz., œdema of the part below due to pressure on veins (vide Case 13), nerve symptoms already noted under the heading "Injuries to Nerves," and mechanical interference with carrying and handling of equipment.

Case 21.—Pte. A. S., aged 22, Rhodesian Regiment, was wounded by a revolver bullet at forty yards range. Entrance wound above left clavicle, no exit wound. X-ray showed bullet lying in fourth interspace left side about one inch from spines of vertebræ. Any pressure applied over part caused slight pain. He returned to duty on April 4, 1916, but was re-admitted on April 3, 1916, owing to pain over the area when carrying his pack. Removal of the bullet was easily carried out under local anæsthetic.

Injuries to Main Vessels.

This complication has been exceptionally rare, and aneurysm has only been noted in two cases (both left subclavian), but it is important to note that, in injuries to bones, the nutrient vessel may be torn, simulating hæmorrhage from a large vessel in the tissues. Examination of the condition of the main vessels below the seat of the wound should never be neglected.

Case 37.—Pte. A. M., aged 25, Rhodesian Regiment, was wounded on March 11, 1916, by an enfilading bullet at an unknown range. On admission, April 14, 1916, there was a linear wound, with a raised flap of skin just below the tubercle of the right tibia, from which quite a large amount of fresh hæmorrhage was occurring. The tibia was fractured. The main vessels at inner side of ankle were normal. There was no exit wound. Owing to the condition of the patient an X-ray photograph was not taken. Treatment was confined to arrest of hæmorrhage and fixation of the limb. Hæmorrhage occurred at irregular intervals until April 12, 1916, when it became rather severe—sufficient to cause a rise in pulse rate and some anæmia. The patient was anæsthetized on April 14, 1916, and three sequestræ were removed. The fractured tibia was noticed to be firm. After the removal of these fragments of bone the temperature of the patient became normal (a rise above 100° F. had never been noticed since admission), and no more hæmorrhage occurred. Swelling of the calf had

been noticed since commencement of hæmorrhage, and on April 24, 1916, the calf became tender, and a sero-sanguineous brownish fluid welled up through the entrance wound. An incision was made into the tissues of the calf but no pus was liberated. On May 3, 1916, the leg showed marked signs of bowing with a rise of temperature. An X-ray photograph was now taken which disclosed the bullet lying two inches below the fractured tibia in front and to inner side. The tibia was markedly comminuted and fibula also fractured. Extension was applied, and on May 23, 1916, the patient was chloroformed and the entrance wound opened up, a counter incision in the calf was made and the bullet extracted, at the same time freeing a large quantity of pus; a drainage tube was passed downwards from the site of the entrance wound and brought out through the counter opening in the calf. From now onwards the patient did well and has, since his transfer to Wynberg, had some more sequestra removed from the tibia. In this case the hæmorrhage was undoubtedly from the nutrient artery of the tibia. Operation was delayed on account of the likelihood of opening new planes to sepsis, and to allow Nature to commence bone formation, in the hope that his leg would be saved.

Results and Methods of Treatment.

The only methods of treatment adopted in this series of cases other than operations, have been :—

(1) Continuous saline baths.
(2) Fomentations.
(3) Hydrogen peroxide.
(4) Massage and movements.

Of these, preference has been given in all cases to the continuous saline treatment, supplemented as occasion demanded by (2) and (3). The whole affected part was immersed in saline at body temperature in a utensil of suitable shape. The saline could be drawn off by a tap and replaced at regular intervals. This treatment was commenced about 7 a.m., and continued throughout the day, and a dry gauze dressing applied at night, so that the tissues had a rest from continuous moisture and did not become sodden—interfering with the process of healing. This intermission of soaking we consider of great importance in the treatment of wounds by this method. The saline baths were continued until there was practically no discharge from the wound and the process of healing was well advanced. Throughout the process—movements of all joints around the affected part have been encouraged, in this way avoiding contracted and stiff joints.

The complete absence of stiff joints, unsightly contractions, adherent scars and deformities, have fully justified this method of treatment. In cases where this treatment was anatomically impossible, i.e., wounds of the face, fomentations were used, scarring and contraction resulting. Treatment has been continued by massage and movements, after cessation of the saline baths.

Treatment by Operation.

Extraction of bullets has been done, in all cases where considered necessary, after definite localization by X-rays in two or more planes. In cases where the bullet was producing no effects—physical or mental—and its extraction would have caused damage to important structures not primarily interfered with, extraction was not attempted.

Drainage and curettage have not been found necessary in our cases owing to the small incidence of sepsis. The difficulties experienced in these extractions were primarily due to reliance on X-rays in one plane only, and to X-rays taken at too long a period before operation. A danger that we constantly bore in mind was that of opening up new planes of tissue to sepsis, when extraction could be carried out at a later date under more favourable conditions. A point of interest in connexion with operation is that, after administration of chloroform in a malarial patient an attack of fever invariably ensued within twenty-four hours. These attacks of malaria have in no way interfered with the healing process.

Conclusions.

The conclusions we have drawn from these cases are that:—

(1) Sepsis is slight and of low virulence in cases of wounds caused by rifle bullets in this country.

(2) Careful note-taking on all cases is of great value, on the lines indicated above.

(3) In all cases of rifle bullet wounds, nervous phenomena should be looked for, whether injury to a nerve is suspected or not.

(4) The main blood-vessel below the wounded part should be compared with the corresponding vessel on the opposite side of the body.

(5) The mental condition should be carefully followed throughout, and after treatment.

(6) All cases of rifle bullet wounds should be X-rayed in two planes whether the bullet is lodged or not, and immediately preceding operation; also if X-ray on one occasion fails to show the presence of a lodged bullet, two or more photographs should be taken before deciding the absence of a piece of metal.

(7) Early movements should be carried out in all cases to avoid contractions and deformities.

(8) Saline baths have been found the most efficacious treatment in all cases of rifle bullet wounds.

REMARKS ON THE TREATMENT OF INFECTED, ESPECIALLY WAR, WOUNDS.

By RUTHERFORD MORISON.

In the first year of the War the accepted rules for its infected wounds were that they must be gaping open and frequently dressed—the same treatment as was adopted for such wounds a hundred years ago—and these threatened to become *the* leading principles of military surgery.

But it is always good to work for an ideal, and mine was to discover some method of cleansing and using antiseptics which would allow of immediate closure of the wound and infrequent dressings of it. I have succeeded beyond my most sanguine expectations, and though not claiming perfection for this method of wound treatment, I do not hesitate to claim that it is an enormous advance on any so far suggested.

It is now certain that if the entire cavity of an infected wound can be thoroughly cleaned mechanically, then treated with suitable antiseptics, satisfactorily closed with sutures, and suitably dressed, it will heal frequently under a single dressing, and in more chronic cases without serious disturbance. This has been proved by hundreds of cases in the Northumberland War Hospital, and in the practice of surgeons who have communicated their results to me. The latest convoys we have had from France show that our method is now widely known, as more than half of the patients bring a card with them stating that they have been bipped. If the difference between these cases and those treated by other methods could be seen by military surgeons, there would soon be no other means used until something better had been demonstrated.

Capt. Anderson, R.A.M.C., speaking at a medical conference at Malta, said: "By the general and systematic use of bipp the work of the Surgical Branch of the Royal Army Medical Corps could be reduced by at least two-thirds." In addition to this I entertain no doubt that lives and limbs have been saved which would have been lost by any other methods, that suffering has been averted, expense diminished, and recovery hastened by this one.

Objections have been noted, such as iodoform or bismuth poisoning, that bipp interferes with X-ray examination after its application, and that bacteriological proofs of its efficiency are lacking; but I am convinced that these objections, important though they may be, should not be allowed to weigh against clinical evidence so definitely in favour of this method in times of such urgency. A study of means to overcome them should be the chief consideration.

The greatest objection, to which my attention was specially directed by Surgeon-General Sir George H. Makins, and one which cannot be exag-

gerated, is the possible danger of gas gangrene from closing these freshly infected wounds at the Front. This problem requires careful handling for settlement, and must be left to the accomplished surgeons who direct surgical advance in the fighting zones.

The most painful and dangerous wounds in the past were those involving the knee-joint. Thanks to the excellent surgery done at the Front, I am able to record a series of cases to substantiate the statement that they now cause the patient and ourselves very little trouble or anxiety.

The following examples of results are from patients at present or recently in my wards at the Northumberland War Hospital:—

Wounds of Knee-joint.

Case 1.—*Wound of Knee-joint by Shell: Removed from External Condyle of Femur.*

A private, aged 31, was admitted to the Northumberland War Hospital on August 27, 1917.

History.—He was wounded in the left knee by a shell on August 7, 1917.

Note from France.—"Casualty Clearing Station, August 7, 1917: Penetrating gunshot wound of knee-joint—entered anteriorly, grooving outer border of patella and entering external condyle of femur, in which it lodged. Wound excised and joint opened up laterally by T-shaped incision. All loose bone scraped away thoroughly, and foreign body removed. (He brought with him the piece of shell, roughly half an inch square.) Bipp rubbed in. Synovial membrane stitched and Dakin-Carrel into subcrural pouch.

"South African General Hospital, August 9, 1917: Wound rebipped and quite clean."

On admission to the Northumberland War Hospital, August 27, 1917: Left lower limb on a Thomas knee splint. On antero-external surface of left knee-joint an irregular wound, $3\frac{1}{2}$ inches by $2\frac{1}{2}$ inches; greater part superficial. At the lower end a deeper portion was packed with gauze. When this was removed, a little bipp came out of the depths. This wound appeared to be deep enough to go down to bone. In the upper part of the wound a Carrel-Dakin tube, which was removed. Wound clean. Some swelling round knee-joint, but no pain, and patient quite well. Rebipped.

X-ray Report.—August 30: "Gutter in external condyle of left femur, and another on the superior external border of the patella."

After admission, patient's recovery was straightforward, without pain or other disturbance. November 1: Wound very small, but not quite healed. Splint left off. November 8: Almost healed. Movement in knee fairly good, though not encouraged yet.

Case 2.—Bomb Wound of Upper End of Tibia and Knee-joint and Popliteal Vein.

A driver, aged 30, admitted to the Northumberland War Hospital on October 3, 1917.

History.—Wounded on September 9, 1917, by an aeroplane bomb. (He had multiple wounds, but only that of the knee will be considered.)

Note from France.—"Canadian Casualty Clearing station, September 9, 1917 : Left knee track of missile through head of tibia cleaned up and removed from posterior aspect of joint in popliteal space. Popliteal vein found to be wounded—tied and dressed. One Carrel tube in head of tibia. Bipp soft parts. Wound closed.

"African General Hospital, September 12, 1917 : Since admission has been cleaned up; swelling at first below wound, but disappeared, and circulation good. Still fever at night."

On admission to Northumberland War Hospital, October 3, 1917 : Left leg in Thomas knee splint. Over inner surface of left knee, and extending on to leg a curved incision wound, six inches long, healed at either end, but about the centre of it a superficial, granulating wound, about the size of a sixpence. Over the popliteal space an incision wound, six inches long, closed at either end, but gaping in the centre, showing a granulating, superficial area, 3½ inches by 2½ inches. The patient made a straightforward recovery. November 8: Wounds healed. Movement of knee-joint fair. Having massage.

Case 3.—Wound of Knee with Shrapnel Ball and Fracture of Patella : Excision of Ball from Knee.

A private, aged 19, admitted to Northumberland War Hospital October 17, 1917.

History.—Wounded on September 21, 1917, in the left knee by a shrapnel ball.

Note from France.—"Stationary hospital, September 21, 1917 : Wound of entry over left patella a little to right of its centre. Joint swollen and painful. Pulse 90; temperature 99° F. *X-ray Report.*—September 22 : 'Shrapnel ball anterior to internal condyle. No bone lesion.' Chloroform and ether. Ball removed ; joint was full of blood, synovial cavity having been traversed with *partial fracture of patella.* Joint washed out with saline, and bipp, ½ ounce, inserted ; stitched up without drain. October 9 : Fit to leave."

On admission to Northumberland War Hospital, October 17, 1917 : Left leg in metal splint. On anterior surface of left knee-joint an irregular, apparently superficial, clean, granulating wound, two inches by one inch. On inner surface of knee, and extending on to the thigh and leg, a curved healed incision wound, six inches long. Slight swelling of knee. No pain nor constitutional disturbance.

X-ray Report (same day) : "There is a vertical fracture of the patella. A few loose fragments are seen about its superior margin, but there is no displacement of main fragments."

November 1 : Almost healed. A little movement in joint.

Case 4.—Shrapnel Wound of Knee-joint, with Fracture of Internal Tuberosity of Tibia.

A serjeant, aged 22, admitted to Northumberland War Hospital on August 22, 1917.

History.—Wounded on August 13, 1917, by shrapnel. (He had multiple wounds, but that of the knee only will be described.)

Note from France.—"Casualty Clearing Station, August 13, 1917 : Left knee-joint : Compound fracture inner edge tibial plateau internal lateral extension of synovia and knee-joint proper ruptured. Knee-joint irrigated with salt and alcohol. Capsule repaired and closed with one thickness of bipp inside. Fracture cleaned, treated with carbolic, alcohol and bipp and ligamentous capsule closed over it."

On admission to Northumberland War Hospital, August 22, 1917 : The left leg was in a Thomas knee splint. On anterior surface of left knee-joint was a gourd-shaped wound, $4\frac{1}{2}$ by $1\frac{1}{2}$ inches, apparently superficial, with a little bipp on its surface. The knee-joint was swollen and contained some fluid. Patient well. No pain. Rebipped.

X-ray report (same day).—"Inner tuberosity of tibia hidden by bipp. No fracture seen elsewhere."

Recovery from all wounds (which also had been bipped) straightforward. October 16 : Convalescent. Flexion of knee to a right angle.

Case 5.—Rifle Bullet Wound of Knee-joint : Fracture of Upper End of Tibia.

A private, aged 19, admitted to Northumberland War Hospital November 10, 1917.

History.—Wounded in the left knee on November 3, 1917, by a sniper's bullet (range about forty yards).

Note from France.—"Canadian Casualty Clearing Station, November 4, 1917 : Through-and-through wound below joint. Compound fracture of tibia. Hæmorrhagic effusion in joint. Joint aspirated. Glycerine formalin two per cent ten cubic centimetres injected. Wounds excised. Track cleaned and bipped. Very little comminution. Hæmorrhage arrested. Wounds closed.

"General Hospital, November 5, 1917 : Glove drain removed."

On admission to Northumberland War Hospital, November 10, 1917 : Left leg in metal splint. On outer surface of left leg just below knee-joint a vertical incision wound four inches long, closed at either end with silk-worm gut sutures. Wound edges not in perfect apposition. Clean. On

antero-internal surface, at same level, a vertical incision wound, 2½ inches long, entirely closed by sutures. There is considerable swelling of, and some fluid in joint but no pain or constitutional disturbance.

X-ray Report.—November 13, 1917: "Gutter in tibia at level of head of fibula. No fracture through the bone."

November 28.—Inner wound healed, outer wound almost healed. Sutures removed. To have daily spirit dressing.

Fractures.

Next to the knee-joint, fractures have been the worst lesions to treat. Such frequent dressings as were necessary from profuse suppuration and the painful movements necessitated, have developed a great output of skilfully devised splints in the endeavour to overcome some of these difficulties. None of them were wholly satisfactory. We are now able so to modify the infection as to leave fractures undressed for weeks, and have returned to the use of very simple splints. Syme is reported to have said that fractures required only a skilful and careful surgeon, Gooch splinting and a penknife for their treatment, and this is as true as most aphorisms are.

Case 1.—*Fracture of Both Bones of Forearm in Upper Third.*

A private, aged 49, admitted to the Northumberland War Hospital on October 3, 1917.

History.—Wounded on September 20, 1917, by a bullet in the left forearm.

Note from France.—"Casualty Clearing Station, September 21, 1917: Operation, 8 p.m. Wound opened up. Both radius and ulna of left arm broken. Through-and-through track. Small fragment of bone removed. Wound bipped. Splint and dressing applied.

"South African General Hospital, September 23, 1917: Wound dressed bipp. September 29: No temperature since admission. Arm was swollen, now better."

On admission to Northumberland War Hospital, October 3, 1917: Over radial border of left forearm just below elbow-joint a large, clean, apparently superficial wound, three inches by two inches, with bipp on its surface. Over ulna border, slightly lower level, another similar wound, about same size but deeper and packed with bipped gauze, but also clean. (Packing removed.) Obvious fracture of both bones in bad position. Loss of sensation in median distribution. Radial pulse normal.

X-ray report.—"Radius and ulna comminuted fracture with inward and backward displacement. The foreign bodies at the wrist are (I believe) all in splint."

Operation.—October 10, 1917: Wounds explored and bipped. Arm put up in good position with forearm fully supinated, in two Gooch splints reaching from the elbow to the finger tips. The anterior splint was turned with wooden convex surface down, to avoid circular compression

of the bones. Supination of the forearm was maintained by an angular aluminium splint (Treves) extending from the shoulder along the back of the arm to the hand. November 3: Dressed for first time (one month after operation). Dressing almost dry. A small piece of shell was picked out of a little hole in the ulnar wound. The radial wound was apparently superficial; some bipp in the middle of it. Arm of good shape and firm bony union. Rebipped and put on metal splint only.

Bacteriological Report on Smear from Dressing. — "*Staphylococcus aureus.*" November 8: Sent convalescent.

Case 2.—Fracture of Both Bones of Forearm with much Displacement. Fracture plated.

A private, aged 25, admitted to Northumberland War Hospital, August 26, 1917.

History.—Wounded on July 31, 1917, by a shell.

Note from France.—"Casualty Clearing Station, July 31, 1917: Compound fracture radius and ulna right forearm, bipped. South African General Hospital, August 1, 1917: Considerable swelling upper arm and of hand. August 11: Dressed under general anæsthetic; put up in Jones abduction caliper splint. Bipp changed. August 24: Dressed. Light gauze pack with bipp. Wounds clean. Little pus. Rectangular splint."

On admission to Northumberland War Hospital, August 26, 1917. Bowing shortening and much deformity of right forearm. Over extensor surface of right forearm at its upper third, and extending on to ulnar border, an elliptical incision wound, clean and deep, packed with bipped gauze. Packing removed, and the lower fractured end of the bare ulna could be seen protruding from the lower end of the wound. Good deal of swelling round elbow. Arm on angular splint. No nerve nor vascular injury. Rebipped.

X-ray Report (August 26, 1917).—"Fracture of both bones 1½ inches below elbow. Ends of ulna are in apposition but at an angle with convexity backwards. Radius lower fragment displaced far backwards with shortening."

Bacteriological Report. — "*Staplylococcus aureus* and Gram-positive bacillus. Fine and short, also club-shaped thick Gram-positive bacillus. Gram-negative bacilli and *B. coli.*"

Operation.—August 31, 1917: No reposition of displacement could be effected by manual efforts. Wound enlarged down back of ulna, and the whole rebipped. The ulna was wrenched into good position with two Lane forceps, and retained there by a Lane plate with three screws at each end. The pricker, the plate and the screws were all smeared with bipp. The gaping wound was drawn together as far as possible by thick sterilized silk sutures, smeared with bipp. This covered and hid the plate but there was a granulating gap, one inch wide at the upper end where skin was lacking. The forearm, fully supinated, was supported by two Gooch splints,

the anterior with the wooden side next the forearm, and the whole was fixed by an aluminium (Treves) splint reaching down the back of the arm to the hand. Anti-tetanic serum 500 units. September 7: The patient has had no trouble nor constitutional disturbance and was up and around the ward three days after operation. Anti-tetanic serum 500 units. October 13: Wound dressed for first time (six weeks). Some caked blood on dressing, almost dry. The wound was closed except for a small superficial, granulating area at the centre. The silk sutures were sticking out like stumps of trees in a burned dry forest, and were removed. Granulating area rebipped.

Bacteriological Report of Smear from Dressing.—"Staphylococci and streptococci."

October 18: Splints removed. November 1: Almost healed; massage. November 21: Healed, arm of good shape; function quickly returning.

Note.—I expected to have to remove this plate at the first dressing and do not know what may be required later. Meanwhile it is causing no trouble and is left alone.

Case 3.—*Fracture of Skull. Fracture of Radius. Wound of Right Thigh.*

A private, aged 33, admitted to the Northumberland War Hospital. September 27, 1917.

History.—Wounded on September 16, 1917, by shrapnel.

Note from France.—"Casualty Clearing Station, September 17, 1917. Gunshot wound head, fracture of outer table. Small button of skull removed for investigation. Inner table negative. Gunshot wound left wrist. Compound fracture of radius. All wounds excised. Bipp.

"*X-ray Report.*—Comminuted fracture of lower end of radius—with bipp.

"General Hospital, September 19: (1) Head wound had been stitched; a little pus at anterior end. (2) Looks fair; plug in. (3) Looks fair; plug taken out. September 21: Scalp wound; no more pus. Slight headache. (2) Plug removed from back of wrist—fracture of radius runs into wrist-joint. (3) Thigh wound healthy."

On admission to Northumberland Hospital, September 27, 1917: Over dorsal surface of left wrist-joint an irregular oval deep granulating wound, 2 inches by $2\frac{1}{4}$ inches, showing bipp. Over radial border of left forearm, $1\frac{1}{2}$ inches above wrist, a small granulating wound. Deformity of wrist like a bad Colles. (Details of other wounds omitted.)

X-ray Report.—"Fracture of radius just above wrist-joint with forward displacement of lower fragment and numerous small foreign bodies. Backward dislocation of arm at wrist."

Operation.—October 3, 1917: Fracture reduced—good position. Wounds rebipped. One thick silk bipped suture in dorsal wound; anterior and posterior Gooch splints. October 27: Dressed for first time since operation (twenty-four days). Dressing almost dry. Wounds healed but for super-

ficial, granulating area, size of a split pea. Arm in good shape and bone firm. Splints removed. To have daily spirit dressing.

Bacteriological Report of Smear from Dressing.—"Staphylococci and streptococci."

November 12.—Sent convalescent. Having massage. Not quite healed.

Case 4.—Gunshot Wound Left Humerus, Left Thigh and Left Foot.

A serjeant, aged 24, admitted to Northumberland War Hospital, October 3, 1917.

History.—Wounded September 23, 1917, by a shell.

Note from France.—"Casualty Clearing Station, September 23, 1917: Wound of left arm excised. Foreign body removed. Brachial artery and veins tied. Oblique fracture of humerus near middle. Bipp. Part suture. Paraffin pack. *Left thigh:* Foreign body removed. Bipp. Suture. *Foot:* Incised. Suture. African General Hospital, September 28: Wound of dorsum of left toe satisfactory. Wound of lower part of left thigh, no pain nor tenderness. Wound of left arm, H-shaped incision and a good deal of oozing. Arm slightly tense. Pulse 94; temperature 98·6° F."

On admission to Northumberland War Hospital, October 3, 1917: *Left arm:* A large H-shaped incision on left upper arm on inner anterior and posterior surfaces—anterior, vertical and transverse limbs of H, each about 3½ inches long, were closed with sutures. The posterior vertical limb, about same length, was gaping, but clean. No radial pulse on left side. Could move and feel fingers but complained of "pins and needles" in them. The arm was on a Jones arm splint. (Details of other wounds omitted.)

X-ray Report.—"Position of fracture obscured by bipp.

Operation.—October 6, 1917: Granulating wound posteriorly rebipped. Sutures removed from healed portion of wound. Splint removed, fracture reduced. Thick cottonwool pad, powdered with boracic acid laid on chest wall and into axilla. Arm bandaged firmly to side. No splints. November 3: Arm dressed for first time (four weeks). Splinted lightly for support. Very little discharge on dressing. Arm of good shape and bone united. All wound healed except a granulating area posteriorly 1 inch by ½ inch, and apparently superficial. Arm released, to be carried in sling. November 18: Arm dressed (second time, fifteen days after previous dressing). Some dermatitis. Pressure sore from splint at bend of elbow. Wound almost healed. To have daily spirit dressing. November 25 Arm much improved. November 28: Sent convalescent.

Case 5.—Fracture of Radius: Ulna grooved.

A private, aged 19, admitted to Northumberland War Hospital, October 17, 1917.

History.—Wounded on October 9, 1917, by machine-gun bullet.

Note from France.—"Casualty Clearing Station, October 9, 1917: Through-and-through wound of left wrist. Radius fractured. Ulna grooved in front. Wounds enlarged, cleaned and bipped. General Hospital: No interference, progress satisfactory."

On admission to Northumberland War Hospital, October 17, 1917 : Over the middle of the radial border of the left forearm was an elliptical, clean wound, two inches by one inch. Over ulnar border, at same level, was a similar wound. No nerve or artery injury.

X-ray Report.—" Fracture of radius only, three inches to four inches above wrist. Some backward displacement of lower fragment. Two small detached pieces, possibly sequestra."

Operation.—October 20, 1917 : Bone displacement reduced. Wounds rebipped and closed by thick silk sutures rubbed with bipp. Arm fixed with two Gooch splints. November 10 : Dressed for first time (three weeks). Dressing quite dry. Wounds healed. Sutures removed. Arm of good shape. Union of bone not quite firm.

Wounds of Legs.

Case 1.—*Sterile after First Dressing.*

A private, aged 19, admitted to Northumberland War Hospital on October 3, 1917, with shell wounds of both legs.

History.—Wounded on September 20, 1917, by a shell.

Note from France.—" American Casualty Clearing Station, September 20, 1917 : Penetrating wound left calf excised. Bipp. Foreign body not looked for, probably shrapnel. Large traversing wound right calf. Track excised. Bipp paste and eusol. South African General Hospital : September 21, 1917 : Bipp dressing. Foreign body not removed from left leg."

On admission to Northumberland War Hospital, October 3, 1917 : On posterior and internal surfaces right calf, about centre, an oval clean wound exposing muscle, $4\frac{1}{2}$ inches by $2\frac{1}{2}$ inches, showing bipp. No nerve nor blood-vessel damage. Rebipped. *Left leg :* on posterior surface of calf, a little above centre, an irregular clean wound, $1\frac{1}{2}$ inches by $\frac{3}{4}$ inch, showing bipp. Rebipped. *Face :* Small healed wound left cheek. Flame-shaped hæmorrhage outer quadrant left eye.

Operation.—October 6, 1917 : Wounds curetted, rubbed with dry gauze, mopped with spirit, dried and bipped. Sutured with interrupted thick bipped silk mattress tension sutures with india-rubber tube and interrupted thick bipped silk sutures for edges. October 17 (eleven days later) : Wound dressed for first time. Dressings dry, sutures all in position.

Bacteriological Report of Smears.—" No growth."

October 27 : Dressed for second time. Wounds healed except at the upper end where one rubber tube had cut in on the right side. November 8 : Sent convalescent.

Case 2.—*Gunshot Fracture of Fibula.*

A private, aged 36, admitted to Northumberland War Hospital on October 3, 1917.

History.—Wounded September 27, 1917, by a shell.

Note from France.—"Australian Casualty Clearing Station, September 29, 1917 : Large wound on outer side of calf. No foreign body present. Bipp and excision."

General Hospital.—September 28, 1917 : Wound redressed. Quite clean.

X-ray Report.—"Fibula fractured three inches down shaft—alignment perfect. One foreign body lies external and posterior to fibula."

On admission to Northumberland War Hospital, October 3, 1917 : Over outer surface of left leg in upper half a large elliptical, deep, clean wound, 5½ inches by 2½ inches, exposing the divided peronei muscles, and through the gap the extensor muscles. Bipp on surface. No nerve nor vessel damage.

Operation.—October 6, 1917 : Wound cleaned and bipped. Muscles sutured with thick catgut mattress sutures. Wound closed as far as possible by interrupted thick tension mattress sutures over drainage tubes and interrupted thick silk sutures for edges. Leg put up in two lateral Gooch splints. October 17 (eleven days later) : Wound dressed for first time. Very little discharge on dressing. Wound not healed and surface covered with coagulated blood.

Bacteriological Report of Smear.—"*Staphylococcus aureus* and streptococcus."

October 27 (ten days later) : Second dressing. Little discharge on dressing. Bipp sticking on small granulating surface in centre where wound could not be closed. Sutures removed.

Bacteriological Report.—"No growth."

November 8.—Sent convalescent.

Case 3.

The following case, though not military, conveys such useful surgical lessons that it is included. It proves the value of a knowledge of first aid, the importance of promptitude and efficiency in a country doctor, and illustrates an important point in blood-vessel surgery.

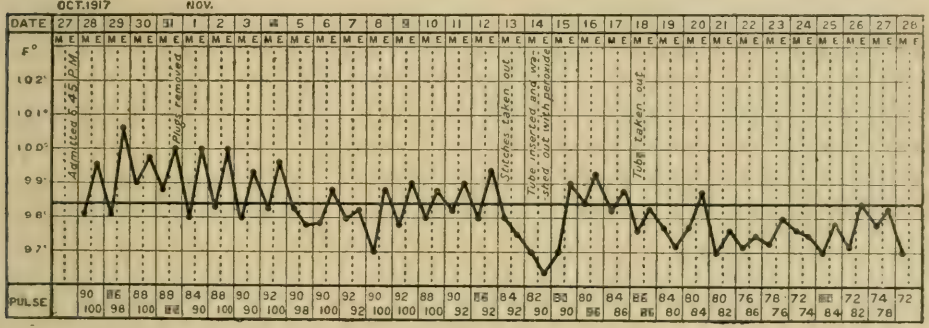
History.—Mr. A., aged 29, was out shooting with his brother on the afternoon of Saturday, October 27, 1917. He gave his gun to a boy to hold while he crossed a stream six feet wide. In handing the gun back the boy presented it muzzle first, and accidentally touching the trigger caused it to discharge. Mr. A. realized what was happening and in order to clear his body jumped up, and received the charge in his left thigh.

Instantly there was profuse hæmorrhage and he fell. The day was wet and cold, but fortunately he was wearing a waterproof coat. His brother, who had a good ambulance training, at once ripped open his breeches at the top and controlled his femoral artery by pressure in the groin. He kept up this pressure until Dr. Brookfield Fox arrived, thirty-five minutes later. The time of the shot firing was accurately established, because Mr. A.'s watch had stopped at 2.17. The doctor who saw at once that serious damage had been done to large blood-vessels, plugged the wound

cavity firmly with sterile gauze which he had brought, applied a tight bandage and having sent for the ambulance started an hour and a half later to bring the patient into a private hospital. Meanwhile the patient, in spite of such wraps as could be found, had got very cold lying on the ground. As soon as he started the doctor sent a telephone message to the hospital stating the nature of the case and asking that everything should be ready for operation. The patient arrived at 7 o'clock and was taken straight to the operating theatre. On admission he was fully clothed, pallid cold and sweating but conscious, and with a radial pulse easily felt. He was anæsthetized at once, undressed, and the wound was examined. On the anterior and inner side of the thigh over the line of the femoral artery, commencing about four inches below Poupart's ligament, there was a lacerated wound about four inches long, extending towards the inner part of the thigh. Some bleeding was still going on through the bandage and plug, but not actively. The femoral artery was compressed and the bandage and plug were removed. The wound was covered by a compress wrung out of 1—20 carbolic lotion and the skin of the thigh was cleansed with the same. There was a great spurt of blood as soon as pressure on the femoral artery was relaxed. The wound was extended to about eight inches long above and internally, so as to allow of free access, and the femoral artery was then seen, bare all round and running like a thick cord down the thigh. There was an opening in it about the size of a split pea at the junction of the upper with the middle third of the bared portion of vessel. A catgut ligature was tied above and below the opening and the pressure on the artery was relaxed. Between the two ligatures and close to the opening free hæmorrhage followed. It was then found that *a large muscular branch was given off close to the opening in the main trunk.* Ligature of this vessel and division of the femoral artery between the ligatures arrested all serious bleeding, but many vessels in the torn muscles oozed and in the depths of the wound a large branch of the profunda bled and was tied. There was no vein discoverable, and it seemed probable that the femoral vein had been completely destroyed. The sartorius and adductor muscles were torn through and much lacerated. Further examination showed that the main trunk of the profunda femoris was intact and that the charge lay almost under the skin on the outer side of the thigh, and was felt by my hand introduced through the inner wound. A large opening was made on the outer side of the thigh over the charge, from which a quantity of clothing, wads and pellets of No. 6 shot was removed. During the operation normal saline (1 dram of salt to 1 pint of water) temperature 100° F. when entering the vein, was given, but the radial pulse disappeared to reappear again later—when 3 pints had been introduced. Both wounds were cleansed as far as possible with the fingers, then scrubbed out with a long strip of sterile gauze pulled to and fro, then by a similar strip of gauze soaked in spirit used in the same way, and finally by a gauze strip covered with bipp, which was scrubbed into the wound surfaces by pulling the

strip from one side to the other. Slow oozing still continued from the lacerated muscles, and to stop this a gauze plug smeared with bipp was packed into each wound. Except where these protruded both wounds were closed by thick, deep, interrupted sutures of silk, soaked in tincture of iodine. The wounds were dressed with sterile gauze and abundant cotton-wool, 500 units of anti-tetanic serum was injected into the chest wall, the patient was put into a warm bed and an enema of one pint of coffee with a tablespoonful of sugar was administered.

After-progress.—Next day the patient had entirely recovered from shock and complained only of pain in his leg. The circulation in it was good, but there was obviously serious damage to the sciatic nerve. Four days later the dressing was removed for the first time and the plugs were taken out. The wounds looked free from any redness or swelling, but the patient's temperature (see chart) indicated a mild infection. Two days



later pus escaped from the inner and anterior wound, and about half an ounce could be squeezed out. Daily dressing was ordered, and suppuration from the inner wound in gradually diminished quantity continued until November 28, when only a small granulating area was left unhealed. Fourteen days after the injury the silk sutures used to close the wounds were removed. They had caused no irritation, and the sutured portion of both wounds healed per primam. He still has some pain, numbness and lack of power in the leg, but it is improving so rapidly that his complete recovery is almost certain.

This case allows me to draw attention again to the importance of an observation I made early in the War and which I published in the *British Journal of Surgery* (No. 10, 1915), and also in my "Contributions to Surgery," p. 491, as an illustrated article.

The point made was that "*The escape of an artery from a bullet is due to its elasticity and mobility. At points where branches arise the artery is tethered by them so that it becomes fixed and is pierced by the impact of the bullet, and the branches are either torn through or caught and divided.*"

I have never seen a more clear demonstration than this case offered,

but our experience of aneurysm and secondary hæmorrhage from damaged vessels fully confirms it.

A second point concerns the treatment I adopted in this case. Was it the best that could be done? I believe not, because though the result has been all that could be desired, we ran risks from prolonging the operation, and did not entirely succeed in preventing wound infection, because the wound treatment could not be made thorough enough. With this experience, and in a similar case, after opening and cleansing and giving ordinary surgical attention to the wounds I would now fill them up with A. E. Morison's magnesium sulphate cream[1] and dress them, leaving the dressing untouched for four days. Then I would bipp them and sew them up.

It is with great diffidence that I venture to suggest this as the most suitable scheme for military injuries which I have only had to treat in the later stages.

In any case, in these serious wounds with shocked patients, some readily applied first dressing, if it has been proved effective, should take precedence of more elaborate schemes. The report in the *Lancet* of November 3 by Captains L. Colledge and Hamilton Drummond and Lieutenant R. Worthington, on proflavine, and suggesting it as a first dressing, also appeals to me.

The advantages of such a first dressing, apart from its ease and the short time required to apply it, are that the objections to my method of treatment would no longer have importance. The most serious of these, because it is true, is that both iodoform and bismuth interfere with satisfactory X-ray examination. The X-ray examination could be fully made before their application if the method I have suggested were employed.

The second objection is that poisoning may follow as a result of bipp treatment. In the early days when wounds were filled with bipp, a few cases occurred, showing absorption. There have been no deaths from this cause in the Northumberland War Hospital, and for the last year no case in my wards has shown any sign (except a blue line round the necks of teeth, especially dirty ones) of this trouble. It may be that absorption occurs more readily from fresh wounds than from those of a few days' duration, though I have seen no evidence of this, or it may be that too much bipp has been left in the wound, or what appears to be a likely explanation is that bipp improperly made up has been used. We have had several samples obviously defective. When it is properly prepared and rubbed in a thin smear sticks to every portion of tissue so treated.

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[1] Method of Preparation of the Magnesium Sulphate Cream.—One to five pounds of mag. sulph. *exsiccatum* are mixed with eleven ounces of glycerine acid carbolic (1—10). The dried mag. sulph. is in the form of a fine white powder which contains twelve per cent less water than ordinary mag. sulph. The glycerine acid carbolic is put in a *hot* mortar and the mag. sulph. added slowly, stirring and mixing with a warm pestle all the time. The result is a thick white cream, so hydroscopic that if exposed to the air it rapidly absorbs moisture and becomes fluid. To preserve it in a jar is essential.

Summary of Technique.

(1) Under an anæsthetic, usually open ether, cover the wound with gauze wrung out of 1—20 carbolic acid, and clean the skin and the surrounding area with the same lotion.

(2) Open the wound freely and, if possible, sufficiently to permit of inspection of its cavity. A guide—a finger is the best if the size of the wound permits of it, and if not a thick probe—should be introduced to the bottom of the wound and held there and fully exposed. In doing this special regard must be paid to nerve trunks and muscular branches of nerves, since the division of blood-vessels, excepting the largest, and of muscles themselves does little harm as compared with that of the disability following nerve damage. Cleanse the cavity with dry sterile gauze mops, Volkmann's spoon, etc., and remove all foreign bodies.

(3) Mop the surrounding skin and the wound cavity with methylated spirit and dry it.

(4) Fill up the whole wound with bipp, rub it well in with dry gauze. Then remove all excess, leaving only a thin smear covering over the wounded surface. Dress the wound with sterile gauze and cover all with an absorbent pad. This dressing requires no change for days or weeks if the patient is free from pain or constitutional disturbance. Should, however, discharge come through, the stained part must be soaked in spirit and a gauze dressing wrung out of the same applied as a further covering.

Redressing is very simply done. After removal of the old dressings the wound is covered with a dossil of wool soaked in spirit, and the sticky, dirty-looking discharge is wiped off the surrounding skin until it is clean.

I am indebted to Colonel Adams for leave to publish the military cases.

A STUDY OF 109 CASES OF TRENCH FEVER, WITH SPECIAL REFERENCE TO THE CONDITION OF THE HEART.

By Major T. J. CREAN, V.C., D.S.O.
Royal Army Medical Corps.
AND
Captain B. H. BARTON.
Royal Army Medical Corps.

In a paper entitled "Trench Fever," appearing in the Journal of the Royal Army Medical Corps for April, 1916, Captain McNee, Lieutenant Renshaw, and Captain Brunt describe an illness affecting officers and men of the British Expeditionary Force in Flanders. The following notes are the outcome of a study of cases of fever with similar symptoms admitted to a divisional rest camp in France. This division was in Flanders from the early summer of 1915 until February, 1916, when it moved into the area it at present occupies in France. Cases of this nature were common in the division last summer and autumn, but undoubtedly became much more common in April and May of this year.

Distribution of Cases.

The authors quoted above state that their cases came from only two classes of men, those in or near the trenches and men of the Royal Army Medical Corps. This series shows a similar distribution thus:—

One infantry brigade provided	16 cases*
Another infantry brigade provided	30 ,,
Another infantry brigade provided	40 ,,
The pioneer battalion provided	3 ,,
The Royal Army Medical Corps provided ..	9 ,,
The Royal Engineers (Divisional Signals) provided	1 case
The Royal Field Artillery provided	9 cases, including one from the D.A.C. and one from the B.A.C.
The Royal Garrison Artillery provided ..	1 case

* This brigade was detached from the division for a time.

In this unit fourteen of the twenty-four N.C.O.s and men engaged in nursing contracted the disease.

Types of Fever.

There appear to be two distinct types of fever: (1) The remittent type with fever of the remittent or intermittent character, lasting from 5 or 6 days to 3 weeks or more (see Chart I).

(2) The relapsing type or "long" type of the authors previously quoted, with fever for 24 to 72 hours, followed by 3 to 6 days' apyrexia, with abatement of symptoms, then a relapse for 24 to 72 hours, then 3 to 6 days' apyrexia, and so on. A very common time for the relapse was on the fifth

day, from the acme of the preceding bout of fever; some cases relapsed every fifth day, others every seventh day, and so on, but seldom absolutely regularly (see Charts II and III).

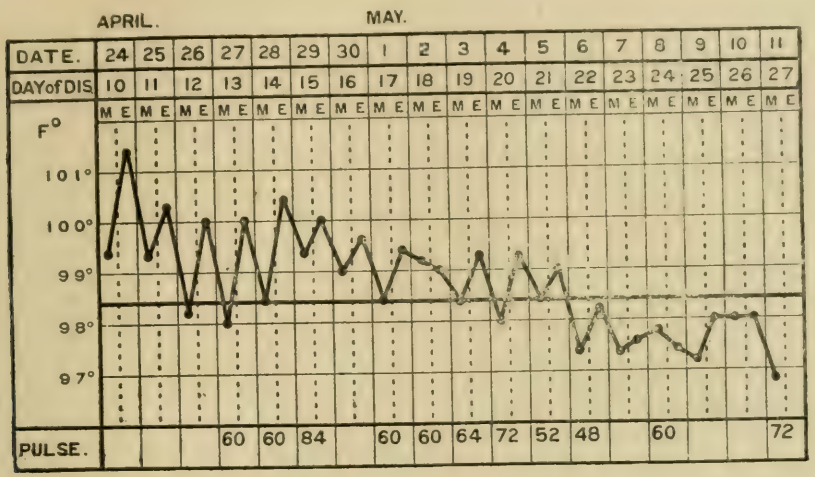

Chart I.

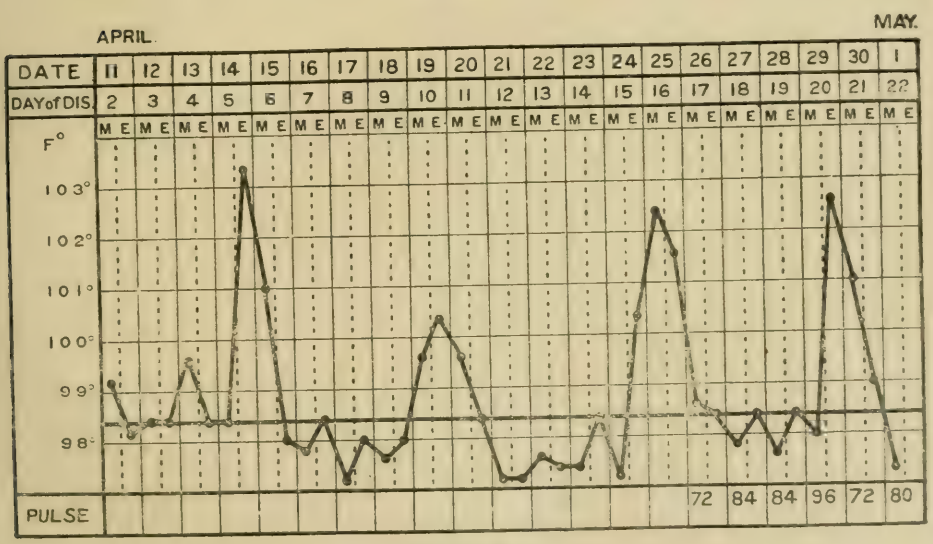

Chart II.

There were many cases that we could not definitely place in either group, as they resembled both, so they are put into a third "indeterminate" group (see Chart IV). Some of these were very interesting, the charts being just like those of Type 2 for ten to fourteen days, but after the second or third relapse they became like those of Type 1 (see Chart V).

Symptoms.—The onset is as a rule sudden with headache, usually

frontal, dizziness, and weakness of the legs, so that the man falls down; there is severe pain in the legs, usually the shins, sometimes in the thighs also, and very commonly in the back; belly-ache is also a common complaint. All the pains are very much worse at night, often coming on regularly at 5 or 6 o'clock every evening. Constipation is almost constantly present; we saw no case of diarrhœa. A slight cough is common.

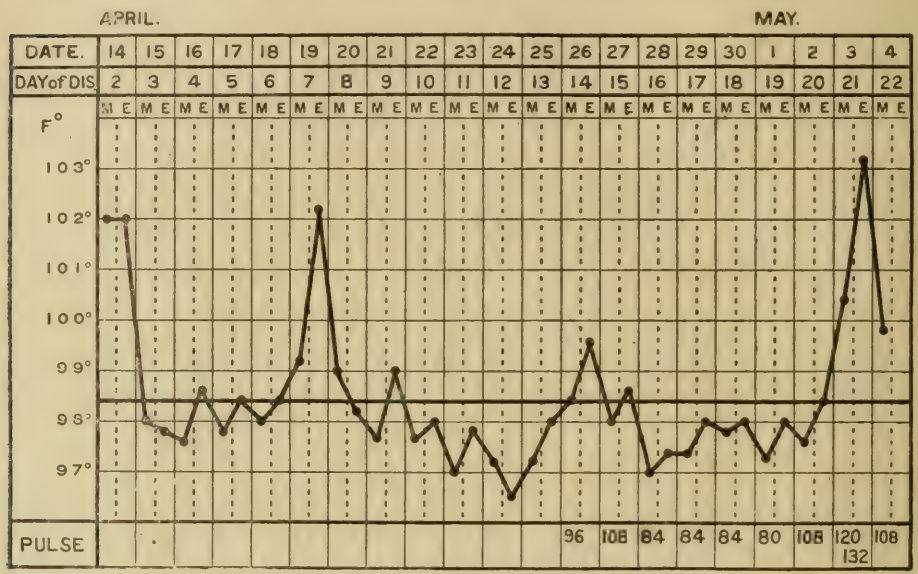

Chart III.

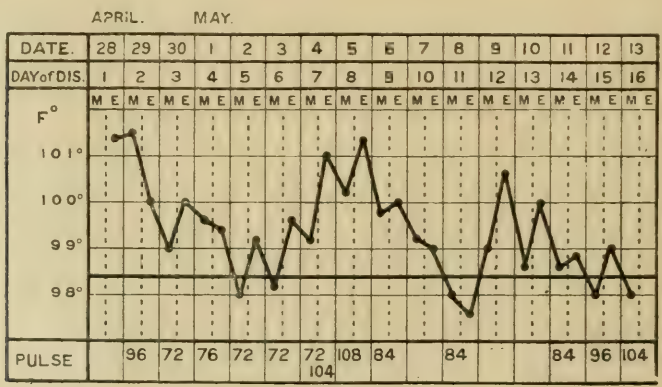

Chart IV.

Physical Signs.—The pulse is full and bounding, the rate about 90 to 108; in those cases in which the myocardium is affected it may be of low tension and a rate of 144 or more. The temperature is usually high, running up to 103° or 104° F. The respirations are quiet and not unduly increased in frequency.

Herpes about the lips and face was noted in several cases. The face, flushed at first, may become markedly drawn after a week's illness from pain and consequent lack of sleep. The tongue is dry, with a yellow-brown fur, which clears in a few days, commencing at the edges, leaving a perfectly clean, moist tongue without noticeable enlargement of the papillæ. The fauces are often congested, but patients do not often complain of sore throat. The lungs as a rule are quite natural, but occasionally there is slight bronchitis.

The heart is quite normal in cases seen on the first day, but the myocardium is very commonly affected after a week's illness, there being sometimes definite dilatation, or more commonly a muffling of the first sound at the apex or a very loud first sound with or without a "slapping" impulse; a systolic murmur at the apex developed in two cases, but in

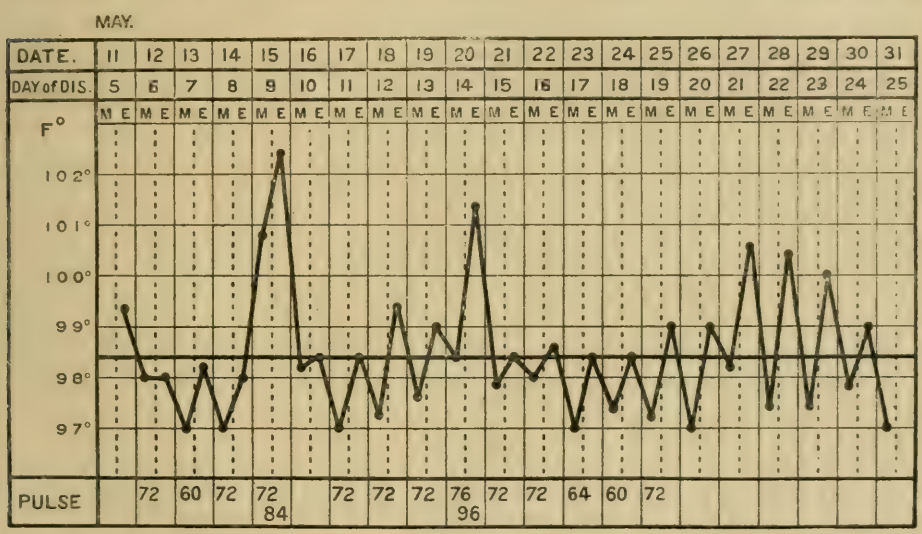

CHART V.

neither instance was it audible in the axilla. In many cases nothing abnormal was noticed till the patient got up, when he had tachycardia and became dizzy and faint, such symptoms persisting unless the patient was put back to bed. The spleen is palpable in a few cases. There is marked tenderness of the shins in some cases; in one case with great pain in the shins there was œdema of the left leg.

There is often marked tremor when patients first get up.

Course.—Of the length of the illness we are unable to speak with certainty, as we only kept patients for twenty-one days; but forty-six cases, or forty-two per cent, were discharged to duty, usually of a light character, on roads, within three weeks of admission to the field ambulance. Regimental medical officers say that the pains in the shins are often very persistent, men complaining of them at night for weeks after their return to duty.

Treatment.—We had no success in attempts to cut short the disease by means of drugs, though we gave a good trial to: (1) Salicylate of soda combined with bicarbonate of soda in doses increasing to forty grains of each every four hours; (2) liquor hydrarg. perchlor. in doses of one dram with iodide of potassium, five grains, three times a day, combined with unguent. hydrarg. co. applied to the shins; and (3) to quinine sulphate in doses increasing to ten grains every four hours.

The main indications for treatment are:—

(1) To keep the patient at rest in bed until the temperature has been normal for forty-eight hours, continuing to keep a careful watch upon the heart after the patient is up.

(2) To keep the bowels well open, starting with calomel three grains, or a No. 9 tablet, then two drams of magnesium sulphate every morning, repeated, if necessary, every two hours.

(3) To ease pain and promote sleep. In order of efficacy we found aspirin twenty grains, at night, the best analgesic; then mustard leaves to the shins; then phenacetin ten grains; then hot sponging the whole body; then tincture of opium ½ dram; then Dover's powder fifteen grains; then pil. opii one grain. All tablets were crushed and given as powders. Painting the shins with iodine had very little effect, and rubbing them with liniment. terebinth. little more.

The Cardiac Condition.—(1) The affection noted was: Dilatation in 21 cases; change in sounds in 38 cases; tachycardia in 3 cases.

(2) Cases placed in groups:—

	Heart affected	Not affected	Percentage of cases affected
(1) Remittent type ..	23 cases ..	9 cases ..	74
(2) Relapsing type ..	18 ,, ..	20 ,, ..	47
(3) Indeterminate type ..	21 ,, ..	18 ,, ..	54
Total ..	62 ,,	47 ,,	57

(3) The effect of *delay in treatment.* The average number of days of illness before admission to this field ambulance was:—

(1) In cases in which the heart was not affected	4·75
(2) In cases in which the heart was affected	7·15

(4) The effect of different drugs:—

Drug	Tried in	Heart affected in	Not affected in	Percentage of cases in which heart was affected
Liq. hydrarg. perchlor. (with potass. iod.)	19 cases	5 cases	14 cases	26
Quinine sulphate	19½* ,,	7 ,,	12½ ,,	36
Sodium salicylate (with sodium bicarbonate)	23½ ,,	17½ ,,	6 ,,	74
Tonic tablets (containing iron, arsenic, quinine and strychnine)	21 ,,	11 ,,	10 ,,	52
Potassium iodide	3½ ,,	½ ,,	3 ,,	14
Phenacetin	½ ,,	0 ,,	½ ,,	0
No drugs were given in two cases		1 ,,	1 ,,	50

* Two different drugs were tried in the same case several times—each drug was credited with ½ instead of 1 in these cases.

The heart was found to be affected in twenty cases on admission.

From the foregoing figures it would appear :—

(1) That cases of the relapsing type are less liable to cardiac affection than those of the remittent type.

(2) That the earlier a patient is put to bed the less likely is his heart to be affected.

(3) That cases treated with salicylate of soda are more liable to cardiac affection than others. It is only fair to state that the earliest cases of the series were treated with salicylate of soda or tonic tablets, and it was only when affection of the heart was found to be common that patients were strictly confined to bed.

We have heard a good deal of the "irritable heart" of the soldier. Possibly many of these cases of irritability have their origin in trench fever, perhaps treated by a day or two off duty.

These notes are published in the hope that D.A.H. may become less common in the British Army.

A NEW TEST TYPE FOR THE DETECTION OF MALINGERERS IN THE ARMY.

By Captain ALAN W. SICHEL.
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In examining the visual acuity of men in the Army the Ophthalmic Surgeon has to contend with a great deal of malingering, and in many cases the detection of a malingerer is a matter of some difficulty.

Out of 1,956 cases where the visual acuity was examined at No. 58 Ophthalmic Centre during a period of twelve months, 101 cases of malingering were recorded, representing five per cent of all eye cases seen. During the three months ending November, 1917, the number of such cases has risen to eleven per cent of the total examined.

By malingering in this connexion is meant the refusal of men to admit having as high a visual acuity as they really possess, whether they be emmetropic, or have an error of refraction small or moderate in amount.

Malingering in the Army differs from that met with by the oculist in civil practice in this respect. In the latter case a malingerer usually maintains that he is blind in one or both eyes, or at any rate that he has no useful vision in one or both eyes, in order to claim compensation for an injury alleged to have been caused by his work. In Army work on the other hand the common type of malingerer met with is one who pretends that his vision, while fairly good, is below a certain standard.

This is due to the fact that in classifying men as to their fitness for the various categories as regards visual acuity certain standards are laid down, e.g., to be fit for category A a man must have at least $\frac{6}{24}$ with either eye without glasses, and at least $\frac{6}{12}$ in the right eye with glasses. Thus, in order to be rejected for category A a man must maintain that he cannot see more than $\frac{6}{36}$ with either eye without glasses, or that he cannot see more than $\frac{6}{18}$ with the right eye with glasses.

Familiarity with the medical inspection room and the usual test type therein displayed has enabled men to become acquainted with the card of letters. They know that the large letter ($\frac{6}{60}$) at the top indicates a low standard of vision, and that the lowest line ($\frac{6}{6}$) means a high standard, the intermediate lines from above downwards representing increasingly higher standards.

It may even be possible that some men get to know that the fifth line from the top ($\frac{6}{12}$) is the minimum standard required with or without glasses for category A.

Accordingly it is found in examining the visual acuity that in many cases the larger lines are read with comparative ease, but nothing can

induce the man to read more than $\frac{6}{18}$, even though he is found to be emmetropic, or having an error of refraction when this is corrected by glasses.

In such cases, when the fundus and media are healthy and the eye is emmetropic, or possesses an error of no great amount which is capable of correction, the examiner can only infer that the man ought to see more, and it is obviously a difficult matter to certify the vision to be up to standard when the man declares he cannot see as much as he is expected to.

In order to detect cases of this kind the writer has devised a test card which is intended to prevent the malingerer from judging the standard by the size of the type.

The card consists of successive rows of letters constructed upon the usual principles as in Snellen's test type, but the size of the individual letter varies in each row ; thus, the top row consists of five letters which should be read at 9, 6, 12, 9 and 18 metres respectively, the second row of letters which should be read at 18, 12, 6, 9 and 24 metres, the third row of letters which should be read at 12, 18, 36 and 9 metres, and the bottom row of letters to be read at 24, 6, 12, 9 and 18 metres. The distance at which each letter should be read is indicated in small type above the letter. There is no letter on the card of a size which should be read at sixty metres, the largest being one read at thirty-six metres. In addition to the arrangement of the letters as described the card employed is smaller than the ordinary test card and this causes the letters to appear relatively larger. There are also only four rows of type compared with seven on the ordinary card.

On being confronted with a card of this kind the man under examination regards the letter (36), being the largest seen, as equal in size to the top letter (60) on the ordinary card. Starting on this erroneous assumption he is tempted to read letters throughout the successive rows one size smaller than he would otherwise have done. It is a matter of some difficulty even for one accustomed to the ordinary test-type to tell at a glance whether an isolated letter is of a size to be read at 18 or 12 metres, or at 12 or 9 metres, therefore to a man not accustomed to the constant use of such types it is exceedingly difficult.

When the malingerer is asked to read the letters he can see, knowing that it would be foolish for him to say he cannot see even the big letters, he commences to read what he judges to be letters of an intermediate size. If he reads all the letters except those intended to be read at six and nine metres, e.g., the top line on the card with the exception of the two smallest letters, it is at once known that he can read $\frac{6}{12}$, and this is all that is required, the minimum standard for category A being $\frac{6}{12}$ with glasses in the right eye. What actually happens is that the malingerer is absolutely bewildered by an arrangement of letters he has not seen before, and in his confusion he blunders into reading smaller letters than he would have done had he proceeded from larger to smaller type.

It is important in using the new card that all ordinary test types should be hidden from view, or else the man is afforded an opportunity of comparing the sizes of the various letters with the type arranged in the manner to which he is accustomed. It is not maintained that every malingerer can be caught in this way, as there is no known method of compelling a man who refuses to read any but the largest letter visible to admit he can see more; nor is the new card intended to take the place of any of the well known methods for detecting malingerers when these are called for, but after a sufficient trial of the new card it has been shown that the large majority of malingerers of this special kind can be detected.

In order to prove the efficiency of the new type the following routine has been followed. The visual acuity was first recorded as shown by a test card of the ordinary kind. Objective examination in the dark room was then carried out, and the refraction noted. The trial frame having been placed in position the vision of each eye was tested by putting a plain glass in front of it, using still the ordinary card. In a few cases the malingerer would read another line or two with the mere addition of a plain glass, but more often than not he still maintained that he could read only what he declared at first. The new test card was then exposed, all ordinary cards being out of sight. In the cases recorded the men were actually shown to have a higher visual acuity by the mere change of cards. The reverse method, i.e., testing first with the new card, followed by an ordinary card, revealed the same difference.

In routine work the vision is recorded at the outset by means of the new card in order that no opportunity may be afforded for comparing the size of the type, i.e., judging the standard. In this way the actual visual acuity, or the nearest approximation to it, is obtained without loss of time and with a minimum of trouble to the oculist in all but a few cases of malingering. The card has also proved of use in examining the vision of neurasthenic individuals who perhaps read as far as $\frac{6}{12}$ on the ordinary test card and then say, "the rest are blurred." On changing the old for the new type they may read $\frac{6}{9}$, or even $\frac{6}{6}$, without hesitation.

The following illustrative cases are appended, a few of the many that have been examined and detected by this means:—

Case 1.—Pte. W., aged 25. R.V. $\frac{6}{36}$, cum plano $= \frac{6}{36}$. L.V. $\frac{6}{60}$, cum plano $= \frac{6}{60}$. Retinoscopy: R. $^{+4}\text{X}^{+7}$. L. $^{+7}\text{X}^{+4}$. fundus and media normal. With new card: R.V. cum plano $= \frac{6}{9}$! L.V. cum plano $= \frac{6}{9}$! R.V. cum + 1·00 sph. $\supset$ + 3·00 cyl.$_{120} = \frac{6}{9}$. L.V. cum + 1·00 sph. $\supset$ + 3·00 cyl.$_{60} = \frac{6}{9}$. Fit for category A.

Case 2.—Pte. G., aged 29. R.V. $\frac{6}{36}$, cum plano $= \frac{6}{36}$. L.V. ditto. Retinoscopy. Emmetropic. Fundus and media normal. Wearing glasses: R. + 1·00 cyl.$_{60}$. L. + 0·50 sph. $\supset$ + 1·00 cyl.$_{110}$. With his own glasses: R.V. $= \frac{6}{24}$. L.V. $= \frac{6}{36}$. With new card: R.V. cum plano $= \frac{6}{12}$! L.V. cum plano $= \frac{6}{12}$!

Case 3.—Pte. J., aged 19. R.V. $\frac{6}{60}$, cum plano $\frac{6}{60}$. L.V. $\frac{6}{60}$. Convergent strabismus. L. eye amblyopic. Retinoscopy: R. $+^{+1}_{+1}$. L. $\times^{+4}_{\text{Emm.}}$. Fundus and media normal. With new card: R.V. cum plano $= \frac{6}{6}$!

Case 4.—Pte F., aged 29. R.V., H.M. only. L.V. $\frac{6}{24}$, cum plano $\frac{6}{24}$. Diffuse corneal nebulæ and irregular astigmatism in R. eye. L. eye: Retinoscopy. Emmetropic. Fundus and media normal. With new card: L.V. cum plano $= \frac{6}{6}$!

Case 5.—Pte. S., aged 34. R.V. $\frac{6}{12}$, cum plano $= \frac{6}{12}$. L.V. $\frac{2}{60}$. Retinoscopy: R. $+^{-0\cdot5}_{\text{Emm.}}$ L. $+^{-12}_{-8}$. Fundus and media normal. With new card: R.V. cum plano $= \frac{6}{6}$! L.V. cum $-$ 8·00 sph. $\frown$ $-$ 4·00 cyl.$_{145}$ $= \frac{6}{18}$. Fit for category A.

Case 6.—Pte. L., aged 41. R.V. $\frac{6}{18}$, cum plano $= \frac{6}{18}$. L.V. ditto. Retinoscopy. Emmetropic. Fundus and media normal. With new card: R.V. cum plano $= \frac{6}{6}$! L.V. ditto. Fit for category A.

Case 7.—Acting-Serjt. B., aged 22. Chelsea Pensioner. Examined for Medical Board. Discharged from the Army with shell shock. R.V. $\frac{6}{60}$, cum plano $\frac{6}{60}$. L.V. ditto. Retinoscopy: R. $+^{+5}_{+5}$. L. $+^{+5}_{+5}$. Fundus and media normal. With new card: R.V. cum plano $= \frac{6}{12}$! L.V. ditto.

Case 8.—Pte. M., aged 18. L. eye enucleated when 6 years of age. R.V. $\frac{6}{12}$, cum plano $= \frac{6}{12}$. Retinoscopy. Emmetropic. Fundus and media normal. With new card: R.V. cum plano $= \frac{6}{6}$!

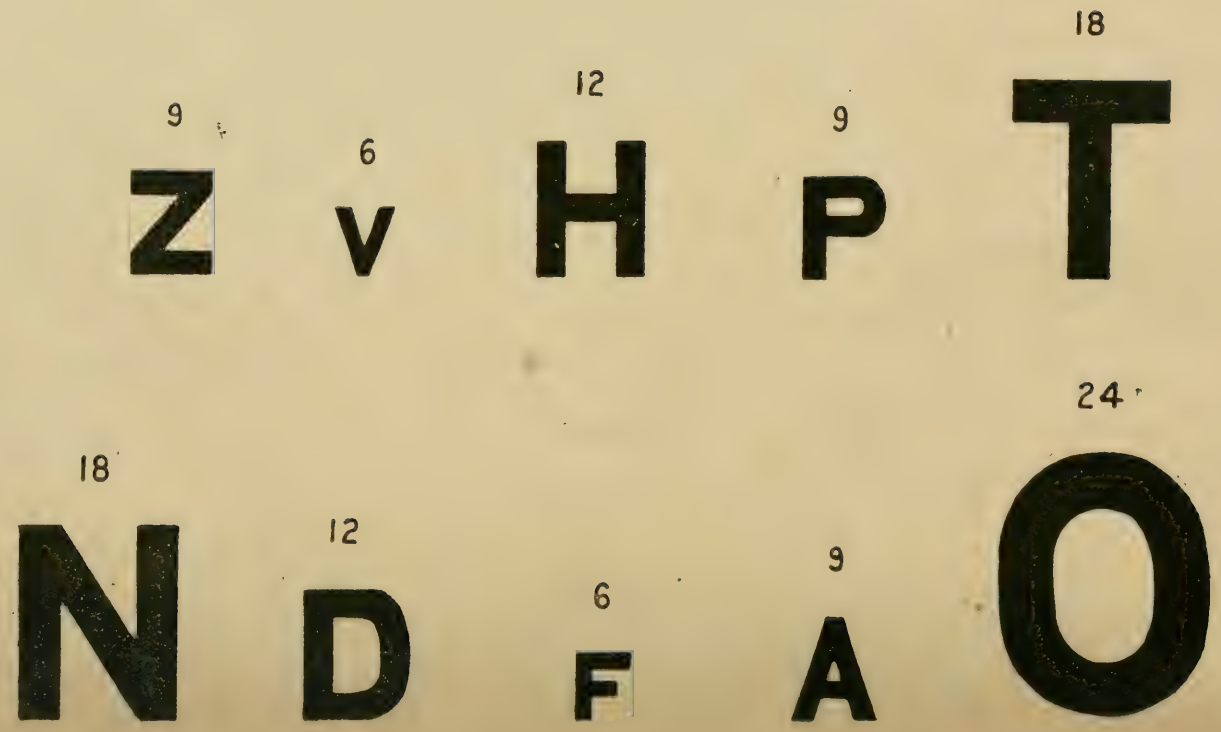
Case 9.—Pte. T. Chelsea Pensioner. Examined for Medical Board. R. eye enucleated owing to G.S.W. L.V. $\frac{6}{24}$, cum plano $= \frac{6}{24}$. Retinoscopy. Emmetropic. Fundus and media normal. With new card: L.V. cum plano $= \frac{6}{6}$!

Case 10.—Gunner T., aged 23. R.V. $\frac{6}{12}$ pt. cum plano $= \frac{6}{12}$ pt. L.V. ditto. Retinoscopy. Emmetropic. Fundus and media normal. With new card: R.V. cum plano $= \frac{6}{6}$! L.V. ditto. Fit for category A.

Case 11.—Gunner O'C., aged 46. R.V. $\frac{6}{60}$, cum plano $= \frac{6}{60}$. L.V. $\frac{6}{36}$ cum plano $= \frac{6}{36}$. Retinoscopy: R. $+^{+3}_{+3}$. L. $+^{+3}_{+3}$. Fundus and media normal. With new card: R.V. cum plano $= \frac{6}{18}$! L.V. ditto. R.V. cum + 2·00 sph. $= \frac{6}{9}$. L.V. ditto. Fit for category A with glasses.

Case 12.—Pte. T., aged 27. R.V. $\frac{6}{18}$ cum plano $= \frac{6}{18}$. L.V. $= \frac{6}{60}$. Central nebula of cornea in L. eye. Retinoscopy: $\times^{+2}_{-1}$. R. eye. Retinoscopy. Emmetropic. Fundus and media normal. With new card: R.V. cum plano $= \frac{6}{9}$! L.V. cum + 1·00 sph. $\frown$ $-$ 3·00 cyl.$_{15}$ $= \frac{6}{36}$. Fit for category A.

A specimen copy of the card described—actual size as used—is appended.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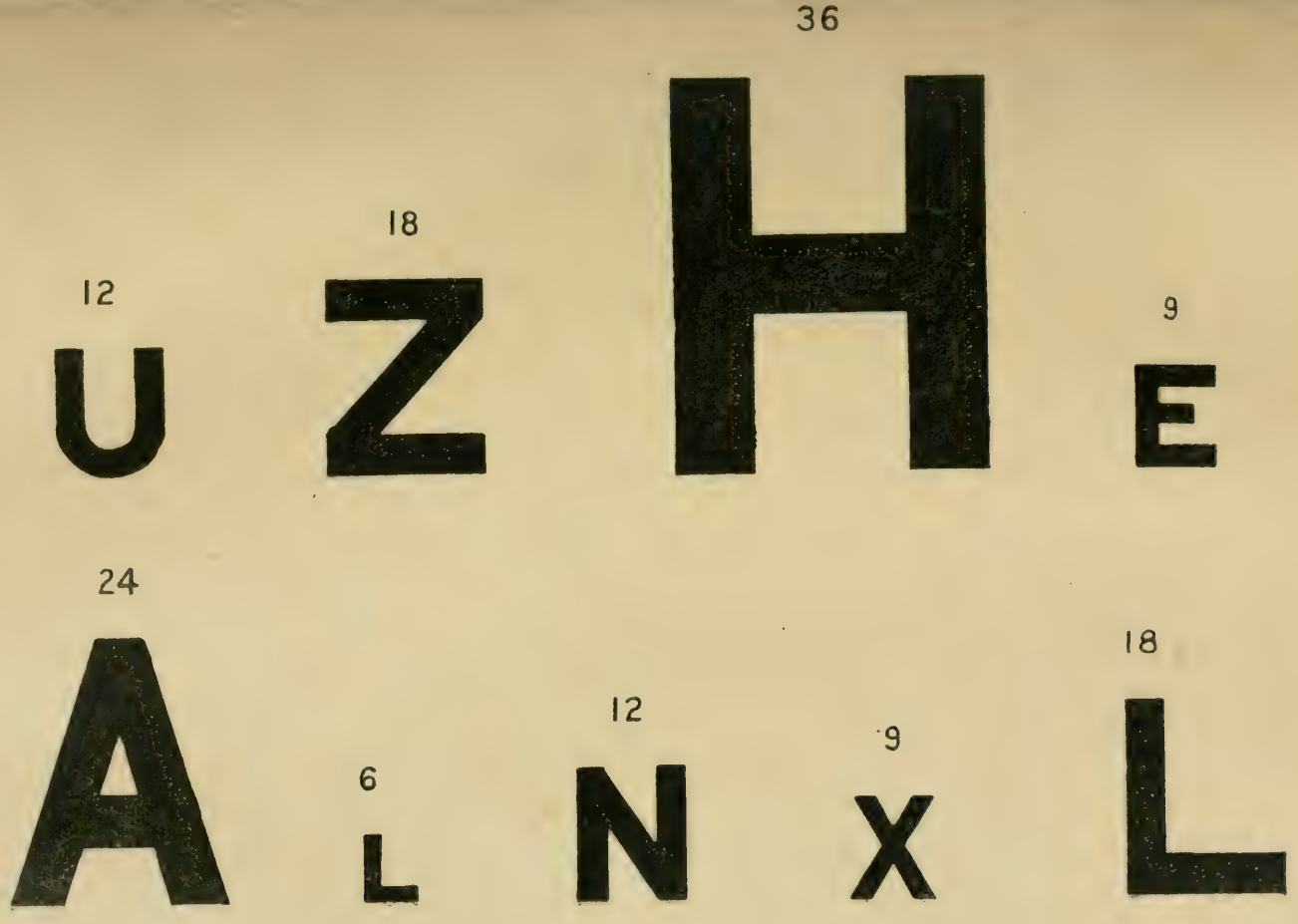
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HERNIA OF THE FORAMEN OF WINSLOW: OPERATION AND RECOVERY.

By Lieutenant H. E. RAWLENCE.
Royal Army Medical Corps.

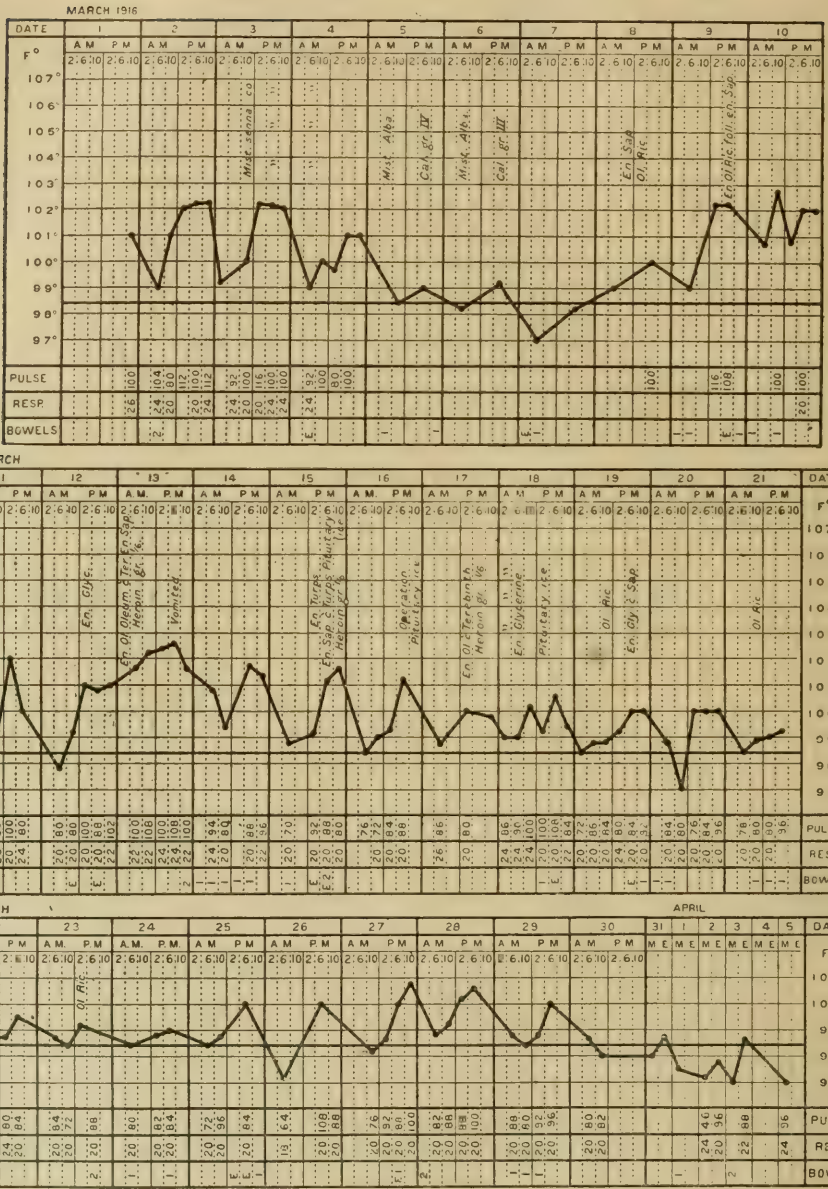
Pte. "B.," R.W.S., aged 18, service one year and four months. Wounded in France, February 2, 1916. Admitted into Military Hospital, Brockenhurst, February 18, 1916. Wound of the left thigh in its upper third on the outer side. The shrapnel passed from above down and out, tunnelling under the skin for some six inches. On admission the parts appeared healthy, and there was very little discharge. February 23: Tube shortened and some stitches removed. February 28: Wound of entrance healed.

Clinical History.—March 1, 1916: Patient was suddenly attacked with severe abdominal pains. The pain was above umbilicus and chiefly on the left side. Patient was obviously ill and had an anxious expression. Abdomen soft and distended. Temperature 101° F.; pulse 120; respiration 26 March 2: Patient better, tongue clean, no distension; bowels moved twice naturally. March 3: After mist. sennæ co. and a large enema several large fæcal masses were brought away. March 4: Patient bright and much better. March 7: Report of blood, urine, and fæces, from the R.V. Hospital, Netley, negative as to enteric and dysentery. Patient taking food well and tongue clean. March 8: A good deal of flatulence but no pain. March 9: 5 p.m., attack of very acute pain; after ol. ric. and soap and water enema he passed a loose motion with a lot of flatus, and was relieved. March 12: Another attack of severe pain relieved by glycerine enema, but recurred again in the night. March 13: A distinct feeling of resistance present for the first time above the umbilicus and more marked on the left side: Patient vomited for the first time. Rectal examination and urine negative. March 15: Another attack of pain, this time of a most violent character; patient vomited and perspired freely. Two enemas failed to relieve. A definite tumour, which gave a tympanitic note, could now be felt above the umbilicus. March 16: Patient feeling better, but tumour still present and in the same situation. Patient seen in consultation with Lieutenant-Colonel Alpin, Officer Commanding, it was thought that the obstruction was in the colon, and was probably secondary to some inflammation near the left kidney. Possibly a deep lumbar or peri-nephric abscess, consequent upon the sepsis in the wound which was in the left thigh.

Operation.—March 16, 1916: Colonel Alpin kindly assisting, chloroform was given by the open method by Lieutenant W. M. Jackson. The patient was turned on his right side, the left kidney region was incised over a length of two inches, and a pair of forceps pushed into the lower pole of

the left kidney. Nothing was found, and a finger introduced palpated the region with negative results. The patient was turned on to his back, and a left rectus incision made five inches long, three inches above and two inches below the umbilicus. The peritoneum was not inflamed. The whole bowel was distended with gas. The colon was empty except for flatus. On passing the hand into the abdomen a mass was felt just to the left of the middle line, in the region of the duodenal-jejunal flexure. The stomach and colon were drawn down and out, and the meso-colon exposed. The mesentery appeared quite normal, except for a tense semi-fluctuating mass behind it. The mesentery was carefully opened through and the lesser cavity of the peritoneum found to contain a coil or two of very distended bowel. It was now evident that the condition was a hernia of the foramen of Winslow. The hole in the meso-colon was now isolated; the bowel was hastily eviscerated into hot towels, and the jejunum about four to six feet from the duodenal-jejunal flexure was found firmly fixed in the foramen. By careful manipulation a small length of bowel was withdrawn. The gut now became fixed. One finger of the left hand was passed into the cavity of the lesser sac, and by careful pressure a tergo and traction a fronte another five or six inches of gut was withdrawn and the last piece of jejunal bowel released. (Without the finger in the lesser sac helping to get gas and liquid fæces passed on down the gut, I do not think it would have been possible to have freed this loop of bowel.) The eviscerated bowel was replaced, the hole in the transverse meso-colon was closed by a purse-string suture and the abdomen closed in layers. Patient was placed in the Fowler position in bed, and continuous normal saline, twenty ounces, with one cubic centimetre pituitary extract B.W. and Co., given per rectum at once. March 16: Patient has made a rapid recovery. March 17: Took fluid by the mouth. Glucose 2 per cent proctoclisis given continuously. March 18: Bowels well opened with a glycerine enema, copious fluid result. Temperature not above 100° F., some pain still experienced in the old position. March 25: Up to this evening patient had been well, then he had a sharp attack of vomiting, with cramp-like pains in the upper half of the abdomen. March 28: Patient much better. Temperature 100° F. at night; pulse 80. Stitches out, wound healed per primam; patient hungry, taking food well, and bowels acting regularly. April 5: Allowed on to a couch. April 16: Sent to an Auxiliary Hospital, Class B. Patient very fit and putting on flesh.

Summary.—Up to the present time, as far as the writer can find in the literature, twenty cases of hernia of the foramen of Winslow have been reported. Blandin was the first to recognize this condition, and published in 1834 the first report of such a case. He was followed by Rokitansky in 1842, and by Majoli in 1884. Our first real knowledge of the subject seems to be the work of two English surgeons, Elliott Square in 1886, and Sir Frederick Treves in 1888. In the *Lancet* of October 13, 1888, Sir Frederick Treves reported a case with post-mortem findings. This class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of hernia he concluded to be the seventh and rarest form of internal hernia properly so-called. The statistics of the cases reported so far are not very detailed, thus of 16 cases, 13 were men and 3 were women. The age varied, the youngest patient being aged 8, and the oldest 77 years. Out of 20 cases, 18 had laparatomy performed with only 4 recoveries, a mortality of 78 per cent. The patient now reported is a male, aged 18. He is short and well built, and made a good recovery.

Etiology.—To Moynihan we owe our knowledge of the etiology of this condition. It was supposed to be due mainly to some violent effort, but as Moynihan points out the abdomen is generally congenitally abnormal in one of four ways. There is: (*a*) A common mesentery for the whole intestine; (*b*) absence of the secondary fusion of the ascending colon to the posterior abdominal wall; (*c*) abnormally large size of the foramen of Winslow; (*d*) abnormal length of the mesentery. In the particular case here brought under review it will have been noticed that an incision was made to the left of the middle line, and that the foramen of Winslow was within easy reach. The object being the recovery of the patient, and remembering Murphy's dictum to "get into the abdomen quick, but out quicker," we did not stop to examine the morbid anatomy. However, on looking over my notes and retracing the steps of the operation, I can feel quite sure that some abnormality was present—probably causes (*b*) and (*c*) as above enumerated. The foramen, after the removal of the jejunum, was very tight antero-posteriorly—only admitting the tips of the first and second fingers. There was some ecchymosis and very distinct thickening and œdema round the portal vein, hepatic artery, and bile duct. So that undoubtedly the foramen was large before the hernia occurred.

Morbid Anatomy.—In most of the cases examined so far the cæcum and colon had become herniated. This was so in Sir Frederick Treves's case. One case is reported in which the ileum was involved a short distance above the ileo-cæcal valve. With the exception of the above case, the literature contains no record of the small intestines or jejunum having become herniated. In the present case the jejunum about six feet from the duodenal-jejunal flexure entered the hernial sac. There was not a great quantity of bowel in the sac; some came away towards the lower portion of the jejunum quite easily, having evidently only quite recently prolapsed. About seven inches or more of the bowel showed signs of having been long in the hernia. After the jejunum had been withdrawn the bowel was in good condition, slightly inflamed with a good deal of œdema of the walls, and near the duodenal end in two places there were fairly extensive sub-peritoneal hæmorrhages. The peritoneum of the lesser cavity was injected and had some serous fluid in it. There was no lymph present nor any signs of peritoneal infection.

Symptoms.—In most cases curiously enough this condition has lasted for as many as six to fourteen days. The pain in all cases has been mostly above the umbilicus, in the present case slightly to the left of the middle

line. The vomiting in nearly all cases has been delayed. The abdomen distended and tympanitic. The only respiratory symptoms present have been a marked rapidity of respiration. In nine of the reported cases it is mentioned that "tumefaction of the supra-umbilical space" was present. In the case now reported this was also very evident. Jonnesco has very graphically described the condition; his description is worth recording: "Je circonscrivais en effect à l'endroit déjà dit, un corps résistant de figure elliptique irrégulière à grand diamètre transversal de 6 centim.' Environ à petit diamètre vertical de 3 centim." The man's bowels were moved freely several times during the period of illness before operation. In the present case the tumour was tympanitic the whole time. In some cases the patients have exhibited a marked tendency to keep sitting up.

Diagnosis.—This will always remain a difficult problem. It is hard to pick out from among the many cases so far reported any symptoms which would be in any way characteristic. The one thing about the tumour which differentiates it from most others in that part of the abdomen is its size and its percussion sound. The quality of tympanites is absent over tumours in this position, due to intussusception cysts, gastric tumours, or any form of carcinoma.

Treatment.—In the first place exploratory laparatomy. Two main methods may now be employed. Jeanbran and Riche strongly recommend Wiart's exposure of the common bile-duct as a means to open up the foramen of Winslow, and by enlarging it to enable the bowel to be withdrawn. On the other hand, Moynihan strongly advises an opening being made through either the gastro-colic or gastro-hepatic omentum. Without being aware of either method (at the time of operation) in the present case the transverse meso-colon was opened just as in a case of gastro-jejunostomy. The last nine inches of bowel was extracted with the right hand in the lesser cavity and the left hand at the foramen of Winslow. Owing to the antero-posterior tightening of the foramen of Winslow the contents of the bowel first withdrawn had all been milked back into the last segment to remain within the hernia. It was only by gradually expressing the contents of the bowel from within the lesser cavity that the segment could be freed from its contents and withdrawn. The opening through the transverse meso-colon in this case certainly gave the best access to the foramen from within the lesser cavity and enabled the fingers to act without difficulty, reaching each other easily and not continually pressing upon or displacing the abdominal viscera, as would be the case in an opening through the gastro-colic or gastro-hepatic omentum.

In conclusion I have to express my thanks to Lieutenant-Colonel W. Alpin, I.M.S., Officer Commanding, for permission to publish this case and also for his kind assistance at the operation. My thanks are also due to Staff Nurse S. S. Wilson for her unremitting care and attention to the nursing of the patient both before and subsequent to the operation.

REFERENCES.

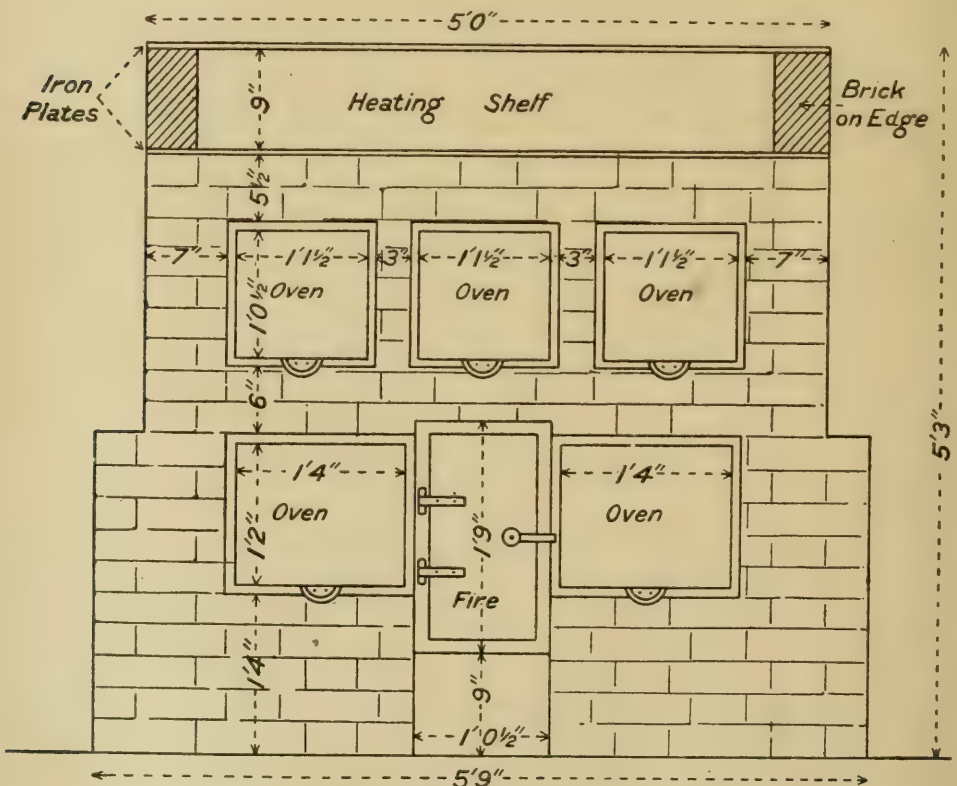
ELLIOTT SQUARE. "A Case of Strangulated Hernia into the Foramen of Winslow," *Brit. Med. Journ.*, 1886, i, p. 1163.
TREVES. "Clinical Lecture on Hernia in the Foramen of Winslow," *Lancet*, 1888, ii, p. 701.
MAJOLI. *Rivista clin. di Bologna*, July, 1884.
BLANDIN. "Traile d'anat. topographique," 1834, p. 467.
TREITZ. "Hernia retro-peritonealis," Prague, 1857, p. 126.
JONNESCO. "Hernies internes retro-peritonealis," chapter 4, Paris, 1890.
MOYNIHAN. "Anatomy and Pathology of the Rarer Forms of Hernia," Arris and Gale Lectures, *Brit. Med. Journ.*, 1900, i, p. 435, February 24.
"Keen's Surgery," vol. iv, p. 103.
JEANBRAN and RICHE. *Revue de Chirg.*, 1906, vol. iv to v.

Clinical and other Notes.

A SYSTEM OF ERECTING PORTABLE STOVES SUCH AS ARE ISSUED TO MEDICAL UNITS, SO AS TO FORM AN EFFICIENT AND ECONOMICAL INDOOR COOKER.

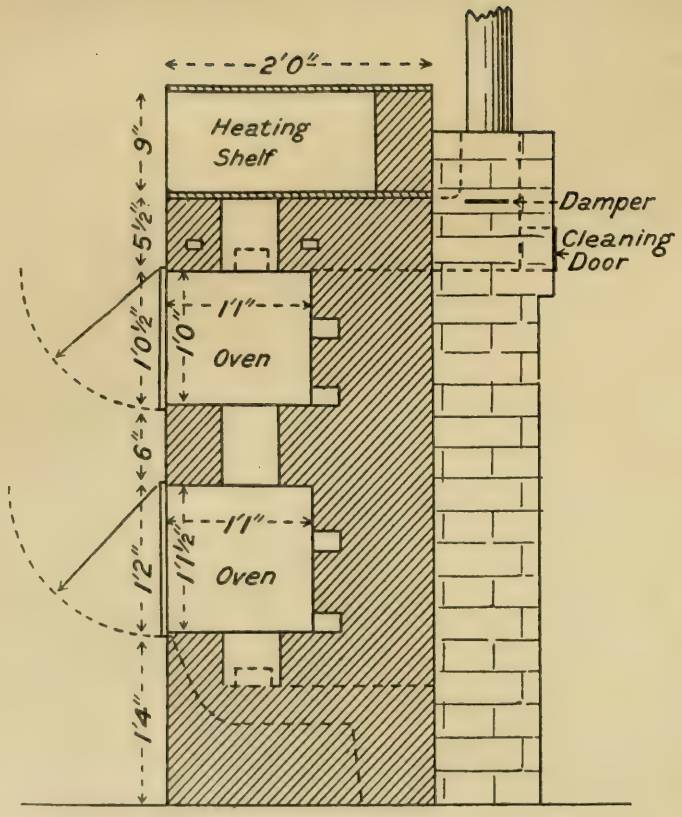
By Lieutenant and Quartermaster R. D. MATTHEWS.
Royal Army Medical Corps (T.F.).

Some time ago, when we "covered in" our open-air kitchen and made it into a cook-house, we were much concerned as to the amount of smoke and soot caused by the fires of the portable stoves of the regulation pattern issued to field ambulances and casualty clearing stations, and it occurred to me that I might remedy this.

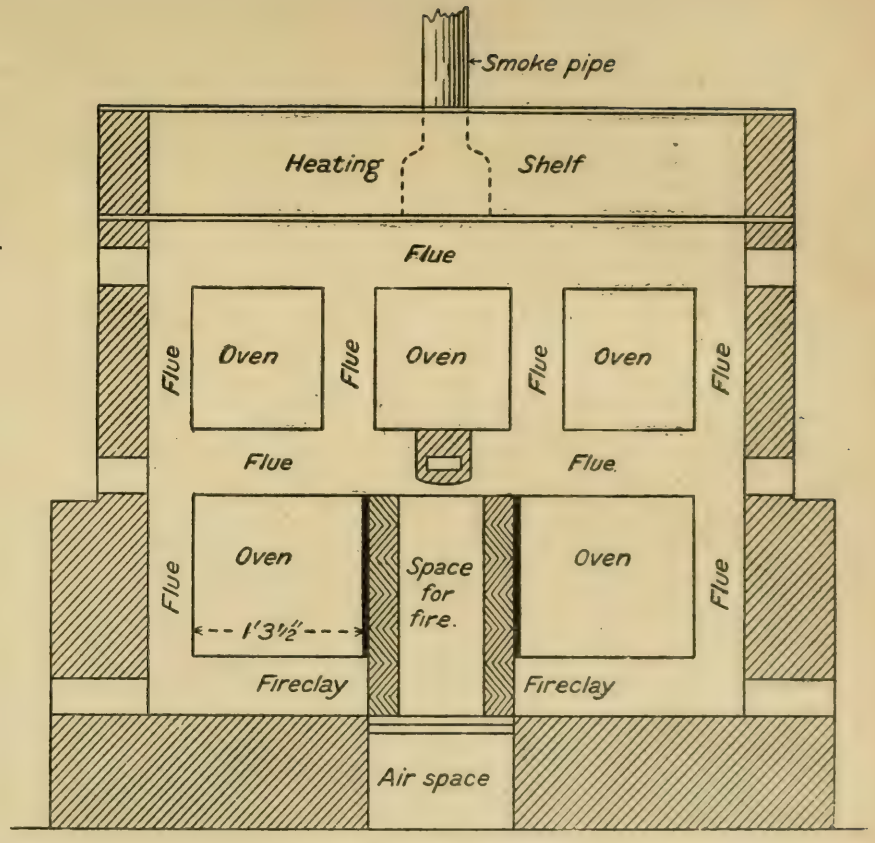


FRONT ELEVATION

I now forward herewith a drawing showing the manner in which we overcame the difficulty by constructing a cooker with a series of five ovens, at the same time reducing considerably the amount of fuel required for heating them.



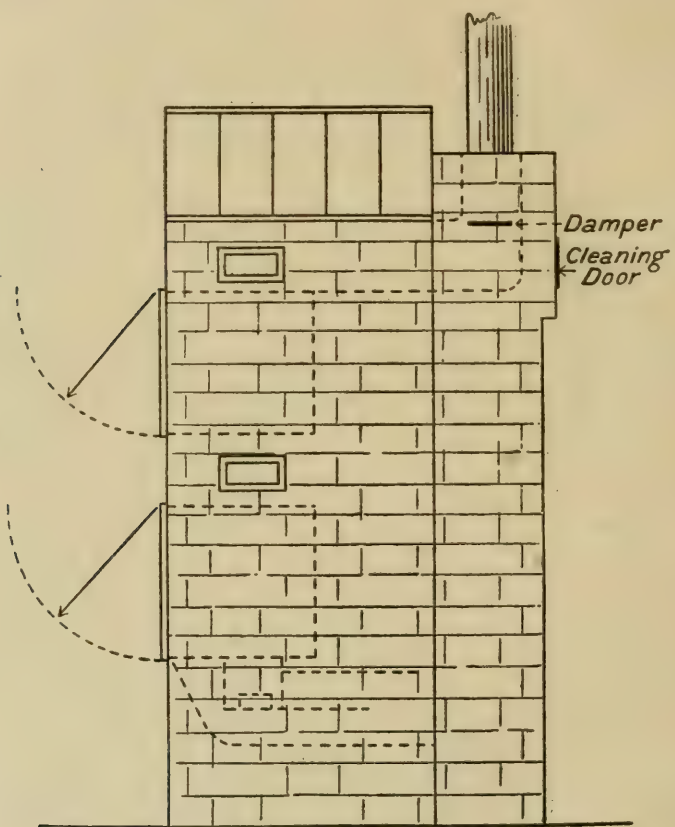
CROSS SECTION



LONGITUDINAL SECTION

The ovens are built into a brick setting with one fireplace for the five ovens, and with flues so arranged as to conduct the heat around the four sides of each oven, a damper being fitted at the smoke pipe whereby the heat can be controlled. At the top of the setting a heating shelf has been made of corrugated iron which is found to be very useful for keeping warm puddings, joints, etc., after they have been cooked sufficiently.

Ordinary bricks may be used throughout, but where fire-bricks are available they are to be preferred in those parts of the cooker which are in direct contact with the flame.



END ELEVATION

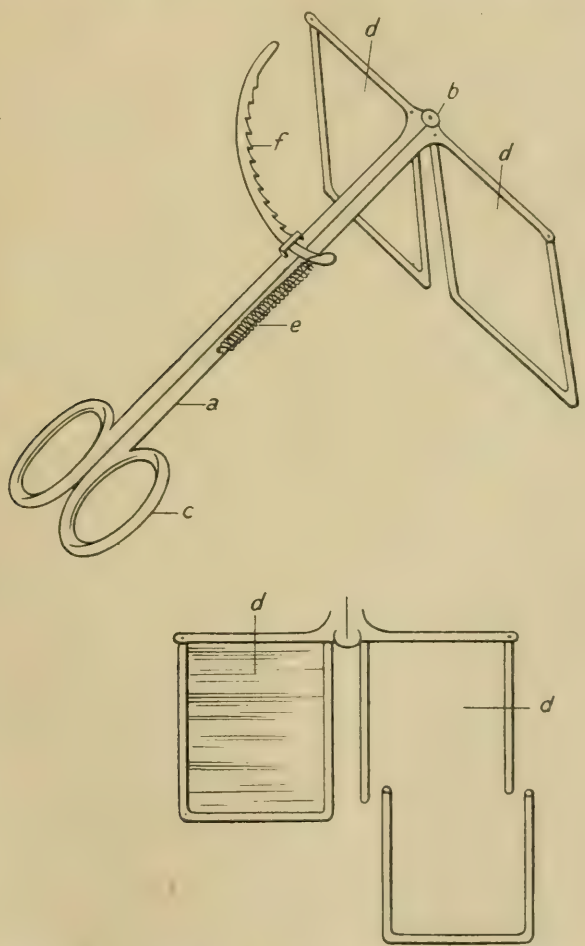
By using this cooker we get rid of the smoke and soot by the smoke pipe through the roof, a much steadier heat is obtained and consequently there is a saving of meat by preventing charring of the surfaces whilst allowing the interior of the joint to be properly cooked. There is a saving of quite fifty per cent in the consumption of coal, and the life of the ovens is more than doubled. The cooker is ready for use within an hour of lighting up, and the five ovens, as shown, are sufficient to cook "roasts" for 150 patients. In addition to roasting meat, milk puddings, bread-baking or any other class of cooking can be accomplished.

The design is so simple that men can be found in any unit who will be able to construct a cooker of this description. Three other cookers of this pattern have already been built by other units in France, and are giving very satisfactory results.

INTESTINAL RETRACTOR.

By Captain W. S. RICHARDSON.
Royal Army Medical Corps.

This retractor consists of two horizontal portions 9 inches long (a) with a hinge at one end (b) and two ringed handles at the other (c). At the hinge end are two vertical diaphragms, covered, when in use, with gauze (d). Each



diaphragm measures 3 inches by 3 inches and is made telescopic so to suit the depth of the wound in which it is to be used—it can be pulled out 5½ inches to 6 inches. On the horizontal part is a ratchet arrangement (f)

controlled by a spring (e) so that the retractor may be opened at any angle up to two right angles, when it is used at its maximum utility.

Gauze bags are made of two thicknesses of gauze and stitched over the vertical diaphragm so that the gauze is taut when the diaphragm is pulled out 5½ inches or 6 inches.

This retractor has proved most useful when portions of fixed gut deep down in the abdomen have to be sutured or stitches put into the bladder. An area of at least 33 square inches can be kept free from intestine, and one can work at a depth of 5½ inches to 6 inches without moving the patient.

The retractor may be introduced into the wound with the diaphragm approximating, and by bringing the handles (horizontal portion) together the required area, free from intestines, may be obtained.

This instrument was made for me by Maw, of London.

THE USE OF THE HAY COOKING-STOVE ON ACTIVE SERVICE, A MEANS OF SAVING FIFTY TO EIGHTY PER CENT OF FUEL.

By Major L. REYNOLDS.
Indian Medical Service.

The difficulty of providing sufficient fuel in the field for cooking purposes is often exceedingly great and consequently any method which will lead to economy of fuel is worth considering.

The hay cooking-stove has been talked about a good deal at home, but the possibilities of this form of cooking have not been taken advantage of on active service, so far as I know.

I will first describe the hay cooking-stove and then explain how it can be adapted for use on active service.

The Hay Cooking-stove.

Take a cooking-pot and a box twelve inches higher and twelve inches deeper than the pot. Put a layer of dry hay six inches deep in the box, place the pot in the middle, surround it with hay and then remove the pot. A nest has been made for the pot.

Now put the food into the pot (vegetables must be sliced, meat should not be more than ½ inch thick) and add sufficient water. As no water escapes, the usual quantity of water should be reduced to two-thirds, otherwise the gravy is very thin and the food loses in taste. Put the pot on the fire and bring it up to the boil. Rest the lid on the pot so that it gets heated up, but do not shut it down or it may boil over or be blown off. Directly it boils adjust the lid, remove the pot from the fire and place in the hay nest already prepared and then fill up the box with hay at once and shut the lid of the box or put something heavy on top to press down the hay fairly tight.

The hay-stove must be placed close to the fire and the pot must be transferred from the fire to the hay as rapidly as possible so that the loss of heat is at a minimum. The hay must be dry. Water is a good conductor of heat and so is wet hay. After the pot has been in the hay-stove for two and a half hours the

meal is cooked. The food cannot be overcooked, but as time goes on it gradually loses heat.

Advantages of the Hay-stove.

(1) As far as fuel is concerned, directly the pot boils no more fuel is required. Of course the time taken to bring the pot to boil depends on many factors. Let us suppose that it takes twenty minutes and that, cooking in the ordinary way, the food is cooked one hour after it has come to the boil. In this case the hay cooker will cook four meals with the fuel sufficient for one meal used in the ordinary way, i.e., the fuel has been cut down seventy-five per cent.

(2) As soon as the pot is in the hay-stove, it requires no further supervision at all. In fact, it must be left rigidly alone until the meal is cooked. This is a great saving of labour which may be used for other purposes.

(3) The resulting meal is very nicely cooked and yet a child could cook it after being shown the way.

Rationale of the Hay Cooking-stove.

The action of the hay cooking-stove depends on two facts.

(1) To cook food it is not necessary to keep it at the boiling point. As a matter of fact it is better cooked if it is kept a few degrees below 100° C.; a cook knows that "galloping" means tough meat, and galloping is no more than 100° C.

(2) If the temperature of a good conductor of heat be raised and then surrounded on all sides by a bad conductor of heat, the former cools down very slowly. The thermos flask is a well-known example of this.

Bearing these facts in mind it is quite easy to make a hay cooking-box without any hay or box. I have made a few experiments to see what can be done.

Boosa can nearly always be got and is just as good as hay.

Earth can always be obtained and if really dry acts quite well. The disadvantages of earth are: (1) that it picks up moisture very rapidly; (2) if bone dry it is more difficult to keep out of the cooking-pot, although this is quite easily managed, as I will show later.

Instead of a box, a hole can be dug in the ground. The following method is quite satisfactory:—

Dig a hole in the ground the same size as the box of a hay-stove (see above). Fill up to six inches from the bottom with dry earth or sand, taken from the surface to ensure that it is dry. Throw away the earth dug out of the hole and have enough dry earth handy to fill up the hole when the pot is in place. When the pot boils, adjust the lid, throw a piece of cloth over the lid to prevent any earth getting into the pot. Then fill up the hole at once with dry earth and press it down. At the end of two and a half hours remove the pot, brush off the earth from the cloth, remove the cloth carefully so that no earth gets into the pot. The meal is now cooked.

In wet weather this method is of course impossible out in the open. Indoors, with a supply of boosa, or dry earth if boosa cannot be obtained, it can be carried out. The boosa or dry earth can be used time after time. This method of cooking is extremely easy to manage and only requires a little care.

The essential points are:—

(1) The material forming the nest for the cooking-pot must be a bad conductor of heat and, therefore, must be quite dry.

(2) The food must be put into the pot before this is put on the fire. If the food is put into boiling water, then it must be left on the fire a few minutes after the pot boils before placing in the hay-stove.

(3) The food must not be in too thick pieces, otherwise it will not be properly cooked (see above).

(4) The hay-stove must be quite close to the fire, and no time lost in transferring the pot and covering it up.

There should be no difficulty in using the hay-stove on active service and thus effect a very great economy in fuel and consequently in transport which can be used for other purposes.

In Mesopotamia, where the difficulties of transport have been so great, this method of cooking should be particularly useful.

A SIMPLE AND RAPID WAY OF MAKING AN OFFICE TABLE.

By Major L. REYNOLDS.
Indian Medical Service.

Materials required.—Eight "Ideal milk" boxes (48-tin size), six "Tanglefoot" wooden boxes, a few planks put together like a bed board, to form the table top (say 6 feet by 3 feet), and a few odd pieces of wood.

Construction.—Remove the lids from all the boxes. Place one milk box bottom upwards on the ground. Take three milk boxes and knock out one end, and then pile them on top of the box already placed on the ground, bottom

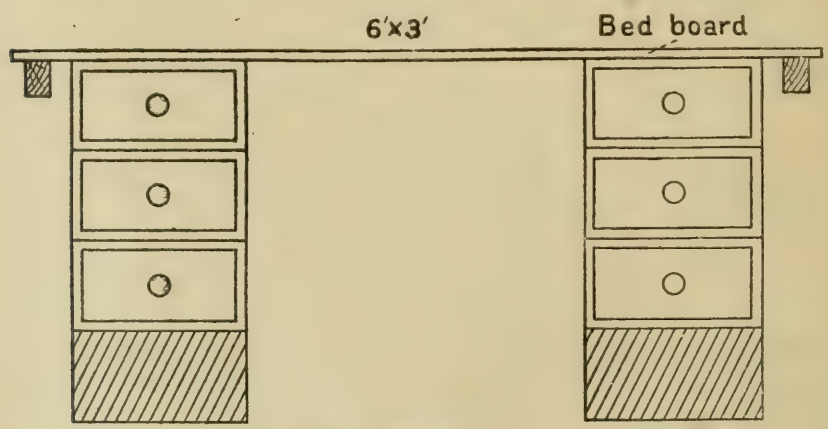
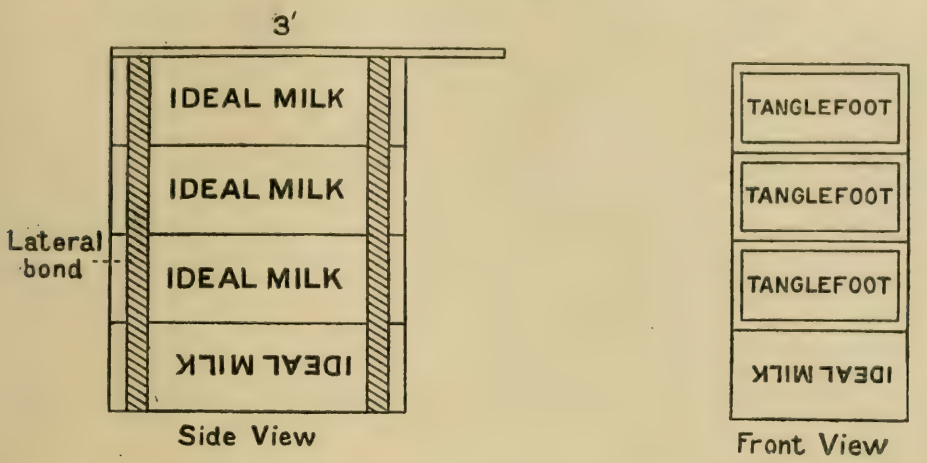


Table Complete.

downwards and the open ends all facing the same way. Now cover the top box with pieces of packing-case wood. This cover is flush with the edge of the pile of boxes towards the open ends and at the two sides, but extend backwards for about six inches, to give a better support to the table top. Fasten the whole pile together with two strips of wood on either side. Slide a "Tanglefoot" box into each of the three upper milk boxes. Fix in some small pieces of wood to

make the drawers fit and prevent them from being pushed in too far. Put handles on drawers. Cover the whole pile of drawers with some cheap cloth to keep out the dust and fix with tin tacks. Now do the same thing with the



remaining boxes. The two supports for the table-top are now ready. The table-top is now made and placed in position. I have had a table made on these lines. It was made in a few hours and is very satisfactory. Diagrams are attached. If the faces of the drawers be planed and rubbed with oil it gives a good finish.

———

PLAN FOR BUILDING A PACK-STORE WITH MINIMUM MATERIAL, LABOUR AND SPACE.

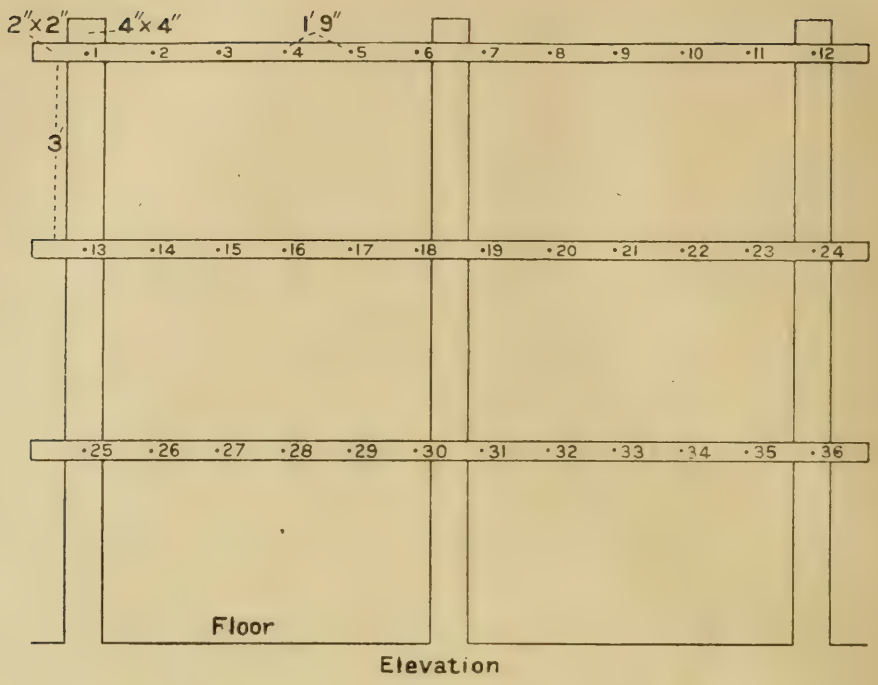
By Major L. REYNOLDS.
Indian Medical Service.

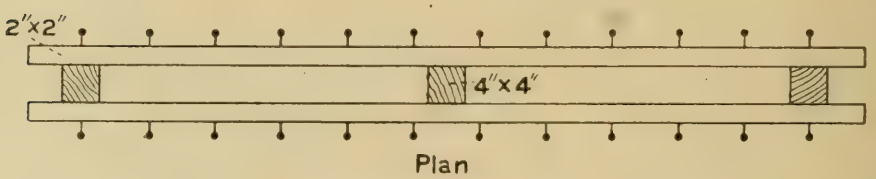
Material required for 500 *Beddings.*—Twenty-one pieces of 4-inch timber 12 feet long. (If built in the corner of a building with strong walls only twelve pieces will be required.) Forty-two poles or pieces of 2-inch by 2-inch wood, 21 feet long (or eighty-four pieces of 11 feet long). 600 nails, 6 inches long.

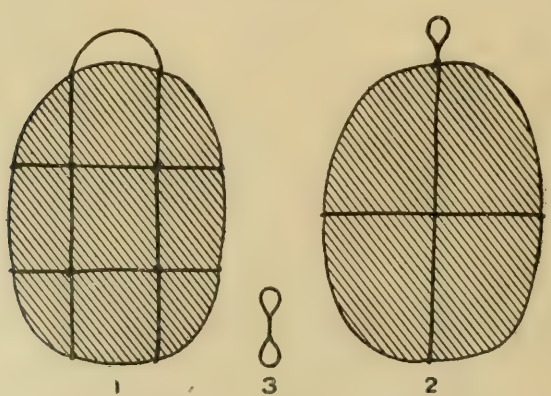
Plan (see Diagram).—The 4-inch timber is used as uprights, sunk 3 feet in the ground, leaving 9 feet above the ground. The uprights are arranged in seven rows, three in each row, with five-feet gangway between rows. The poles are arranged in pairs, one on either side of a row of uprights; there is three feet between the ground and the first pair of poles, and the same between the first and second pairs and between the second and third pairs. The six-inch nails are driven into the poles, leaving an interval of one foot nine inches between two nails; the nails are numbered. The pack store is now complete.

The beddings are tied up as shown in the diagram and are hung from the nails by the loop at the top of the bedding.

This plan can be easily modified to suit local conditions.







METHODS OF TYING UP BEDDING.

No. 2, more economical in rope, requires a small piece of rope with loop at each end. This is passed under the rope binding the bedding, then the loop at one end is passed through the loop at the other end. The bedding hangs by the free loop.

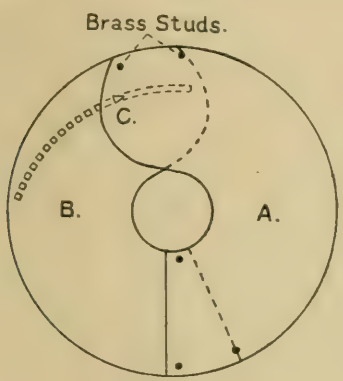
The space occupied by the above-described pack store is twenty-one feet by thirty feet. This is very much less than that taken by the ordinary pack store.

A pair of steps which will stand by themselves, four feet six inches high, is very useful for arranging the beddings. Plan attached.

IMPROVISED AMPUTATION SHIELD.

By Captain VALENTINE H. BLAKE.
Royal Army Medical Corps.

During a short but strenuous period of work at a casualty clearing station taking "walking wounded," I was struck with the need for an amputation shield. When there is a heavy press of work it is not always possible to have a clean assistant to retract the flaps, with the result that the single-handed operator is harassed by loss of time and sometimes by finding he has not been able to remove enough bone.



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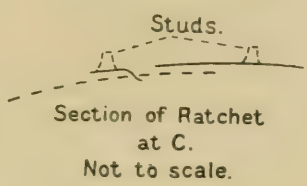
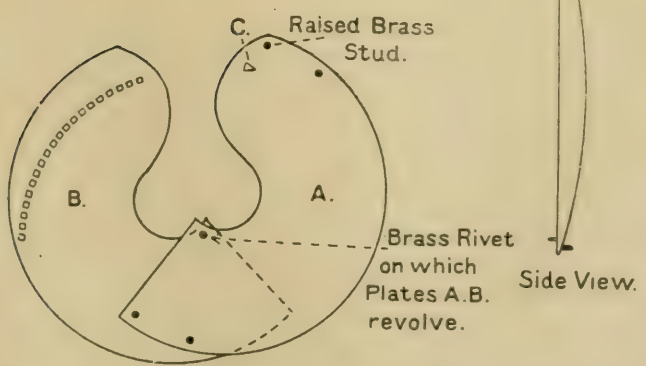




Open.

⅕ Full Size.

Colonel T. Sinclair, Surgeon Consultant to this unit, very kindly offered some suggestions, with the result that I was able, with the help of Lieutenant R. C. Foster, R.E., to get the following apparatus made:—

Two semi-circular sheets of stout brass are hinged by a single rivet and slightly dished to give the hand and saw free play. A circular slot cut in the centre allows the shield to be adjusted to the bone, and a tongue of metal on one leaf operating on slots on the other leaf forms a quickly acting ratchet holding it in place at the most convenient position. Studs are provided on the covering plate so that the whole can be very strongly retracted by loops of bandage held by assistant who is well out of the way.

In practice, the shield is very rapidly applied and adjusted, giving ample room for the surgeon. There is no fear of the leaves giving or separating, for the greater the pull by the assistant, the more firmly do the plates hold. I have not provided a slot for the fibula in amputations below the knee, but I could do so without any difficulty and without spoiling the efficiency for femur and humerus operations. The brass was cut from two 18-pounder shell cases.

The plates are $8\frac{3}{4}$ inches across, dished one inch. The studs, $\frac{1}{2}$ inch long, are placed on the circumference of the covering plate, one at each corner and one at each diametrically opposite point.

The slots in the covered plate are set at a slight angle to facilitate engagement with the tongue in the plate above.

I submit this note with the kind permission of Lieutenant-Colonel A. H. Morris, R.A.M.C.

A CASE OF "TRENCH FEVER" CONTRACTED IN ENGLAND.

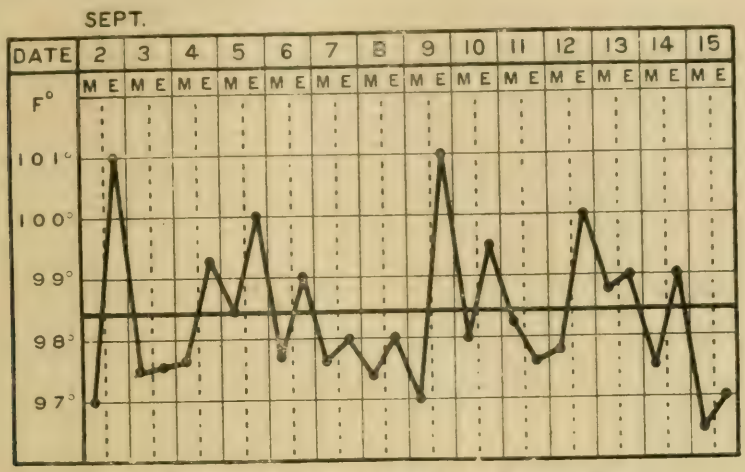
By Captain R. D. MACGREGOR.
Indian Medical Service (Retired).

The case of "trench fever" here described is recorded because the patient has never been out of England, and has contracted the disease while in hospital in attendance upon cases of trench fever from France. As has been the case in a number of instances occurring abroad, the patient is a Royal Army Medical Corps orderly.

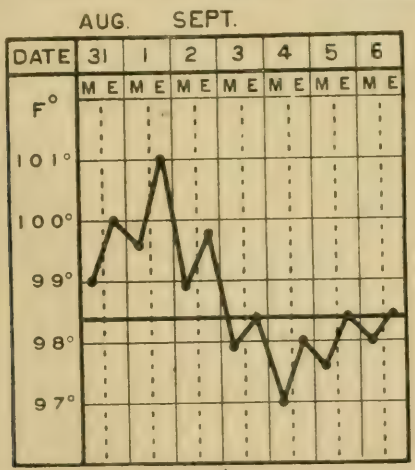
Pte. A., R.A.M.C., has been employed for some months at this hospital as a ward orderly, and bears a good character. He is aged 54, and has had no serious illness except appendicitis, for which he has been operated upon. He has never had rheumatism.

On August 30, 1916, he had acute pain in his legs all night. For three days before this he had had some aching in the legs, but had carried on with his duties. On the morning of the 31st his legs were so acutely painful that he could not stand, and was brought up to the hospital on a stretcher. On admission the fronts of the legs were found to be very tender to the touch, this being most marked along the inner border of the tibiæ. There was headache, and some tenderness and pain over the front of the thighs. Temperature in the evening 100° F. On the next day the evening temperature was 101° F., the symptoms continuing the same. On the fourth day the temperature came down to normal, and remained so thereafter, but there was but little remission in the pain. He was not able to stand with ease until about the seventh day. In addition to the leg pains, headache was frequent, and pains began to locate themselves in different parts of the body—transversely across the chest below the nipples, in the

neighbourhood of the hips and of the shoulders. At the present date (November 5) there is pain, which he describes as "cruel" in the left shin, but none in the right. There is also pain in the right shoulder. Pains are usually worse at night and in damp weather. Throughout the illness, there have been no pathological signs except the initial pyrexia.



Pte. T. Twelfth week of "long" type of trench fever.



Pte. A. "Myalgic" type of trench fever. (Contracted in England.)

The case is a fairly typical one of the "myalgic type" of trench fever. Trench fever, as it has been described up to date, has no completely uniform character, but presents a symptom-complex easily recognized and divisible into a number of well-marked types. McNee, Renshaw and Blunt [1], also Hurst [2], have described a "long" and a "short" type of trench fever. To these Houston and McCloy [3] have added the "myalgic" type, as well as "septicæmic" type.

The case described above belongs to the "myalgic" type, which in general characters is very similar to the other types, but differs in having a short duration

of pyrexia with a long duration of the pains. The myalgic type of patients and the "long" trench fever type in this hospital differ only in the temperature chart, which in the first named shows but a few days' pyrexia, while in the second a course of low irregular pyrexia extending over many weeks is shown with occasional spikes rising a degree or too higher.

The "short" type of trench fever has not been seen in this hospital, possibly because such cases do not find their way over from France. The "septicæmic" type of Houston and McCloy has also not definitely been established here.

It is notable that the various types merge into one another, thus showing the essential identity of the symptom-complex of trench fever. There is no catarrh nor definite joint pains, but a variety of exceptional symptoms may occasionally give rise to diagnoses of "gastralgia," "influenza," "rheumatism," etc.

The excessive duration of fever and pains in the "long" type, and of pains alone in the "myalgic" type, were at first a source of concern, because the weeks went on without any apparent end to the condition. The physical state of the patients seldom gave cause for anxiety, but no form of treatment tried appeared to effect a cure. The passage of time, however, has shown that the most obstinate case finally yields to the "vis medicatrix naturæ," though the longest case took as many as fifteen weeks to do so. There is a gradual amelioration of the pains, the malaise disappears, and the temperature gradually settles upon the normal line.

In the case of Pte. A., given above, the pain has latterly occurred in the left shin only. This is exceptional, only one other case with this peculiarity having been seen, for the leg pains are in almost every instance bilateral.

REFERENCES.

[1] *British Medical Journal*, February 12, 1916.
[2] *Lancet*, October 14, 1916.
[3] *Lancet*, October 7, 1916.

Report.

INTERIM REPORT OF THE WAR OFFICE COMMITTEE FOR THE STUDY OF TRENCH FEVER.

Transmission Experiments.

The Committee was formed, with Surgeon-General Sir David Bruce as Chairman, in December last by the Director-General, Sir Alfred Keogh, acting on a suggestion received from France regarding the co-ordination of research on this most important subject.

The Committee at once set themselves to try to solve the problems of the causation and spread of the disease.

In view of the already widespread belief that the body louse was the guilty agent (unpublished experiment by Major A. C. H. Gray, R.A.M.C. ; also Davies and Weldon, *Lancet*, February 3, 1917), steps were at once taken to feed lice bred from "clean stock" on trench fever patients of whom there were at the time many in the New End Section of the Hampstead Military Hospital under the charge of Major W. Byam, R.A.M.C., a member of the Committee who has supervised the clinical and experimental work.

The Committee were fortunate in having Mr. Bacot, of the Lister Institute, to control the supply and feeding of the lice.

Two volunteers, Messrs. Cole and Edgeler, came forward on January 3, 1918, for the purpose of the experiment from patriotic motives, as they were well over military age and not able to serve their country in more strenuous ways. Lice were taken from clean stock bred in this country. These lice were fed at intervals on many febrile and afebrile trench fever patients at all stages of the disease who had been sent over from France and had relapsed in this country. The lice were then placed on the volunteers, directly on the skin without any intervening gauze, the shortest interval between feeding on a case of trench fever and on the volunteer being six hours. After feeding they were returned to the box and kept in the incubator at 25° C., until again required. This experiment was commenced on January 5, and was continued daily for one month, at least 500 lice being used every day. The feeding experiment in one of the men was then discontinued, and although he has now been under observation for over two months he has showed no signs of fever.

The experiment was continued on the other man, but the conditions were altered : lice were fed on febrile cases of trench fever, and then after intervals of at one time fifteen minutes, at another of one hour and two hours, on the volunteer daily up to February 13, but again without any positive results as regards development of trench fever.

At the Committee meeting on January 28, Major Byam, in reply to a question, stated that these men did not scratch themselves, and indeed, purposely refrained from scratching, this excluding to a large extent infection by means of

excreta or crushed bodies of the lice; he therefore proposed that two more volunteers should be obtained and "scarification" experiments carried out.

On February 5, two men, Seymour and Sullivan, who also volunteered, were used for this purpose.

In the case of Sullivan, a small area of skin, one inch square, was lightly scarified and a small quantity of the dried excreta taken from the boxes of lice which had fed on trench fever cases was dusted on to this area and rubbed in.

On Seymour's arm, eleven lice, taken from a trench fever case, were crushed on the scarified area.

On February 14, Sullivan was suddenly attacked with typical trench fever after an incubation period of eight days. On February 16, Seymour also went down with fever, incubation period ten days.

This dramatic result was at once (February 19) reported to the Director-General, Army Medical Service, and also to the Medical Investigation Committee in France, with whom the Committee had been in close collaboration throughout, all minutes and results of experiments having been forwarded, and in addition, Lieutenant Peacock, R.A.M.C., who had assisted Mr. Bacot in the earlier work here, was loaned to the Medical Investigation Committee on January 24, to assist in the same work in France. The fever which these men developed was indistinguishable from that produced in other volunteers by an injection of whole blood from trench fever cases who had contracted their disease in France. In view of the importance of this discovery the Committee decided to repeat the same experiment.

Three other volunteers at once came forward, Messrs. Reynolds, Tullett, and Glover. These men were each inoculated on February 19, on a scarified spot on the forearm with a small quantity of dried excreta from boxes of lice fed on trench fever cases.

On February 26 Reynolds went down with trench fever; on February 27 Tullett was taken ill, and on February 28, Glover, the incubation periods being six, seven, and eight days respectively.

The chain of evidence was completed by the fact that a small quantity of blood taken from Reynolds on the second day of his fever and inoculated into volunteer Ward produced a typical attack of trench fever after an incubation period of five days.

The fever in every instance, although mild, was yet typical of the so-called trench fever—sudden onset; temperature of 103° F.; pain in the head and limbs, and over the spleen—the initial attack of fever lasting two or three days and followed in practically every case by a relapse or relapses at an interval of usually seven days, the fever in the relapse being lower and more transient, with a recurrence of the symptoms associated with the initial attack.

It will thus be seen from the above experiments that it has been shown that the bite alone of the infected louse does not produce trench fever, but that when the excreta taken from such lice was scratched into the skin, fever followed in every instance, the average incubation period being eight days.

This observation is of great importance in view of the prevention of the disease, and would explain cases of trench fever arising in wounded men who may have had no lice on them for some weeks, as the dried excreta if blown on to a raw surface would readily give rise to the disease. Some further experi-

ments carried out at Hampstead on the migration of lice are also of great interest; as it has been shown, that if two men be available, one with a normal temperature and the other with fever, the lice will leave the fever case and pass quickly to the man with the normal temperature. Experiments are now in progress with the excreta of normal lice, as it is possible that the disease is not necessarily carried from man to man by lice, but simply from louse to man.

In view of these results and their corroboration by the Medical Investigation Committee in France, it is hoped that a very determined campaign will be instituted against the louse, and thus eliminate, or at least reduce, the incidence of a fever which has up to now caused so great a drain on our man power at the front.

The fact that these experiments have been carried out in London is of the first importance, as there can be no suspicion of an accidental or natural infection, as the men employed had not been out of England for many years and had been under observation for some months previous to the experiments; also they were housed entirely apart from the hospitals in which the cases of trench fever were being cared for.

The funds for this research have been provided by the Lister Institute of Preventive Medicine.

Reviews.

STATISTICS *re* GONORRHŒA. By Major H. C. Donald, R.A.M.C. (T.) and Captain A. M. Davidson, R.A.M.C. (T.C.)

This is a companion volume to the graphic record reviewed above. In the introduction the authors draw attention to the seriousness of gonorrhæa, the necessity for more individual treatment than was possible in the large numbers of patients under their control, the limitations of treatment of the developed disease, and the high proportion of complications of all kinds (75 per cent). They conclude the introduction with a plea for a more determined effort to eradicate the disease by education and prevention. The remainder of the book is devoted to statistics relating to over 2,000 patients. It contains numerous points of interest, such as the incidence of complications, the effect on these on the duration in hospital, and a comparison of different forms of treatment. As to the latter, the criticism of the reviewer is that their value is considerably diminished by the fact that the different series were not under identical conditions, being treated at different periods of the year and under conditions which, to the knowledge of the reviewer, must have differed considerably in important details.

The book which, like its companion, is type-written and bound, has been placed in the Royal Army Medical Corps Library, with a number of bound volumes showing the progress, etc., of every patient included in the statistics.

L. W. H.

I.—THE PSYCHONEUROSES OF WAR. By G. Roussy and J. Lhermitte. English translation.

II.—HYSTERIA OR PITHIATISM AND REFLEX NERVOUS DISORDERS. By J. Babinski and J. Froment. English Translation.

These two volumes, dealing with the functional nervous disorders observed during the War, are complementary to each other and should be in the hands of all medical officers, who have soldiers suffering from "shell shock" under care and treatment. The reader must not expect to find in these volumes a complete account of the psychoneuroses or war hysteria, the object of the authors being rather to give clinical pictures of the various functional and reflex nervous conditions, which are observed both in the casualty clearing stations and in the base hospitals.

The volumes are written mainly with the object of instructing medical officers who have received no special training in methods not generally known, which will help them to recognize more readily the many manifestations of hysteria. The present War has afforded an exceptional opportunity for appreciating the rôle played in the genesis of this disorder by the emotions, concussion and local trauma. The number of soldiers suffering from hysterical disorders is considerable and many of them have been kept in hospitals for long periods under mistaken diagnosis or in receipt of unsuitable and entirely misplaced methods of treatment.

It is therefore very essential that the true nature of the psychoneuroses should be recognized as early as possible and that suitable treatment should be provided at the earliest practicable moment. The French Military Medical Service recognized this early in the war and established special centres for the treatment of these patients in the zones of the armies.

It is scarcely necessary to refer to the various clinical conditions graphically

described in the volumes under review. That upon the psychoneuroses deals briefly, in addition, with the difficult question of malingering and its relation to hysteria and gives a good account of the psychical conditions which may be regarded as hysterical. In the second volume Babinski describes in detail reflex nervous disorders, upon which the War has thrown much fresh light. Cases of atrophic paralysis and reflex contracture have been described for many years, but the War has called fresh attention to them, and in this volume the first full account of these important conditions is given to the medical profession. According to the authors they are very common and it is most important for every medical man to learn to diagnose them.

The volumes form part of a series of Military Medical Manuals translated from the French, under the general editorship of Sir Alfred Keogh. They are of convenient size and the letterpress is accompanied by a number of well-executed photographic illustrations. W. A. T.

Military Medical Manuals: Typhoid Fevers and Paratyphoid Fevers. Symtomatology, Etiology, Prophylaxis. By H. Vincent and L. Muratel. Translated and Edited by J. D. Rolleston, M.D. Published by University of London Press, 18, Warwick Square, London, E.C. Price 6s. net.

This little volume, as the authors state, gives a concise account of the progress made in the clinical, therapeutical and hygienic study of the enteric fevers, and should serve as an excellent guide for the medical man who, perhaps for the first time, is called upon to diagnose and treat such diseases.

A very great deal of valuable information is crowded into these pages. The first chapters treat of the clinical characters of typhoid fever in its ordinary form and also in the more obscure and unusual manifestations.

This is followed by a very complete description of the paratyphoid fevers in their clinical aspect, although it is not claimed that these fevers can be differentiated by any one symptom from true typhoid fever; this chapter contains in addition to original observations of the authors numerous quotations from a large number of different French observers.

It is unfortunate, however, that attacks of food poisoning due to *Bacillus enteritidis* and *B. aertrycke*, on the one hand are not more clearly differentiated from attacks of fever due to *B. paratyphosus* A and B on the other.

The same confusion is shown in the chapter on the etiology of the paratyphoid fevers where it is stated that the paratyphoid bacilli may "readily multiply in animals." Again, the contagious character of meat is explained by "what we have said with regard to the latency of the paratyphoid B bacillus in the pig's intestine."

In Chapter IV the diagnosis, both clinical and laboratory, is treated in a masterly manner, and the fact that the latter method is essential for a differential diagnosis is insisted on. In the description of the methods of isolating the infecting organism from the excreta, no mention is made, however, of the use of brilliant-green which has proved of much assistance in our laboratories, especially for the isolation of the paratyphoid bacilli.

Again, in the description of the Widal test it is stated that "normally human serum agglutinates the typhoid bacillus at 1 in 10 or 1 in 20 and the paratyphoid bacillus at 1 in 50 or 1 in 150." This is certainly not common in our experience. Also the statement "that the agglutinating power of inoculated men may be wakened into fresh activity by any disease of a non-typhoid nature" has not been confirmed to any extent by British workers, although the possibility has been recognized. Nor do we agree that "the results of agglutination tests are absolutely useless in those who have been inoculated." No mention is made of the method first introduced by Army bacteriologists, when

testing the Widal reaction in inoculated men, of carrying out a series of careful estimations by the macroscopic method; this method has undoubtedly been of the greatest assistance in the differentiation of fevers.

The chapter on treatment is full and complete, and also deals with diet and vaccine therapy.

In the chapter on etiology the "favouring" causes are discussed, such as climate, age, fatigue, etc., and the infectivity during the incubation period of the fever is insisted on. The rôle of the carrier is summed up thus: "In the Army the rôle of the carrier in peace time is certainly limited to a few special cases, but it becomes considerably more important in camps, and especially in war time."

Direct and indirect contagion are discussed, and the two schools of thought are reconciled and placed in their true perspective. The rôle of the fly is also considered, and although we may not all agree that the statement that "the typhoid bacillus lives in the intestines of flies, and they are true bacillus carriers" is scientifically correct, yet we can all agree that "flies act as a powerful and formidable intermediary and as a factor of contagion of the first rank."

The last chapter is devoted to a subject which is peculiarly M. Vincent's own, namely, prophylactic vaccination. A very full account is given here of the history of anti-typhoid inoculation in the various armies, and numerous figures and instances are quoted to show its undoubted efficacy. One very important point is made, and that is, that inoculations made on men who are fatigued will give rise to severe reactions, and rest both before and after inoculations is insisted on whenever possible.

The authors conclude by saying: "It cannot be doubted that as typhoid fever has shown itself very fatal in past wars, it would have been destined to play a preponderant rôle in the pathology of the present War if prophylactic measures, especially vaccination, had not been applied energetically, continuously, and conscientiously."

D. H.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

March, 1918.

EXTRACTS FROM THE "LONDON GAZETTE."

War Office,
February 23, 1918.

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Military Medal to the undermentioned Non-Commissioned Officers and Men :—

No. 1598 Serjt. R. W. Smith, M.M., Royal Army Medical Corps (Gateshead-on-Tyne). (M.M. gazetted June 3, 1916.)

No. 42093 Pte. (Acting Lance-Cpl.) E. J. Trim, M.M., Royal Army Medical Corps (Frampton). (M.M. gazetted August 23, 1916.)

No. 421062 Pte. W. J. Fryer, M.M., Royal Army Medical Corps (Wolverhampton). (M.M. gazetted November 11, 1916.)

No. 57417 Serjt. J. McL. Donald, M.M., Royal Army Medical Corps (Forfar). (M.M. gazetted November 16, 1916.)

No. 6434 Cpl. (Acting Lance-Serjt.) T. Waterman, M.M., Royal Army Medical Corps (Gillingham). (M.M. gazetted December 9, 1916.)

No. 57780 Serjt. T. Wood, M.M., Royal Army Medical Corps (Bermondsey). (M.M. gazetted March 12, 1917.)

No. 65457 Serjt. B. W. Gunn, M.M., Royal Army Medical Corps (Sudbury). (M.M. gazetted June 18, 1917.)

No. 46951 Cpl. H. Scandrett, M.M., Royal Army Medical Corps (Islington).

No. 38024 Cpl. (Acting Serjt.) C. E. Brooker, M.M., Royal Army Medical Corps (Tunbridge Wells).

No. 508435 Pte. H. Tanton, M.M., Royal Army Medical Corps (Wembley). (M.M. gazetted July 18, 1917.)

No. 70884 Pte. W. Booth, M.M., Royal Army Medical Corps (Denton).

No. 301288 Lance-Serjt. (Acting Serjt.) T. B. Elmslie, M.M., Royal Army Medical Corps (Aberdeen).

No. 305181 Serjt. A. Gorrie, M.M., Royal Army Medical Corps (Dundee). (M.M. gazetted December 17, 1917.)

No. 341263 Pte. O. Dolan, M.M., Royal Army Medical Corps (St. Helens). (M.M. gazetted in present *Gazette*.)

His Majesty the King has been graciously pleased to confer the Military Medal for Bravery in the Field to the undermentioned Non-Commissioned Officers and Men :—

ROYAL ARMY MEDICAL CORPS.

No. 45514 Pte. A. C. Amey (Southfields).
No. 33703 Pte. C. J. Ashman (Putney, S.W.).
No. 35408 Pte. A. Bagshaw (Birmingham).
No. 40729 Pte. (Acting Cpl.) W. Baseley (Birmingham).
No. 7594 Pte. W. H. Beake (Portsmouth).
No. 386076 Pte. C. N. Bell (Newcastle-on-Tyne).
No. 386262 Pte. N. Bell (Rowlands Gill).
No. 339119 Pte. J. Blake (Liverpool).
No. 49069 Pte. H. Bland (Bury).
No. 386031 Pte. F. Bredin (Newcastle-on-Tyne).
No. 74626 Pte. W. Bridgford (Stourport).
No. 390530 Pte. H. L. Brown (Hull).
No. 459037 Pte. A. Burridge (Plymouth).

No. 405267 Pte. H. Carter (Sheffield).
No. 388420 Pte. E. W. Coatsworth (Bishop Auckland).
No. 61603 Pte. J. Cooper (Portsmouth).
No. 386350 Pte. R. Cruddace (North Easington Colliery).
No. 35791 Cpl. A. Davies (Rock Ferry).
No. 58054 Pte. E. M. Davies (Aberdare).
No. 4604 Pte. B. Dempster (Darlington).
No. 459431 Pte. P. J. Doidge (Torquay).
No. 341263 Pte. O. Dolan (St. Helens).
No. 386128 Pte. T. W. Farbridge (Newcastle).
No. 31842 Pte. C. Farrell (Dublin).
No. 7265 Pte. J. C. Finigan (Portsmouth).
No. 20294 Pte. W. Fish (Manchester).
No. 44672 Pte. M. Gaffney (Cowdenbeath).
No. 388109 Serjt. C. W. Garraway (Bishop Auckland).
No. 386057 Pte. H. Graham (Newcastle).
No. 322083 Pte. J. Graham (Glasgow).
No. 30808 Pte. J. Grierson (Middlesbro').
No. 37016 Pte. A. Hall (Leeds).
No. 64877 Pte. A. Hamilton (Stevenston).
No. 66607 Pte. F. Hamlin (Exminster).
No. 56484 Pte. (Acting Lance-Cpl.) J. Hancock (Rugeley).
No. 52295 Serjt. H. E. Hardy (Upper Clapton).
No. 45772 Pte. J. C. Harradine (Quorn).
No. 103741 Pte. H. Haslam (Bolton).
No. 18344 Pte. (Acting Serjt.) A. Hayden (Leyton).
No. 80445 Pte. W. H. Heath (Caversham).
No. 50426 Pte. G. Henson (Derby).
No. 56668 Pte. J. Hughes (Market Drayton).
No. 8980 Pte. W. Kelly (South Shields).
No. 390156 Pte. T. Kennedy (Hull).
No. 106029 Pte. F. R. Kennerley (Hale).
No. 36049 Serjt. A. Killan (Oldham).
No. 339149 Serjt. J. A. Mason (Liverpool).
No. 7838 Pte. J. McEwen (Ayr).
No. 301052 Lance-Cpl. P. M. Morrison (Aberdeen).
No. 53896 Pte. T. Muir (Sauchie, by Alloa).
No. 390361 Pte. W. C. P. Nixon (Redcar).
No. 714 Pte. (Acting Cpl.) W. Parry (Merthyr Tydvil).
No. 81113 Pte. A. Petrie (Blairgowrie).
No. 42062 Serjt. (Acting Serjt.-Major) W. J. Post (Redhill).
No. 39642 Pte. H. E. Prescott (Birmingham).
No. 3061 Pte. S. Price (Birmingham).
No. 38401 Lance-Cpl. W. Purves (Peebles).
No. 68333 Pte. F. M. Rackham (Dalston).
No. 91687 Pte. S. R. J. Rattey (Camberwell).
No. 20551 Pte. M. Reed (Kendal).
No. 33170 Pte. W. H. Reid (Brixton).
No. 78760 Pte. T. Richardson (Middlesbro').
No. 459376 Pte. (Lance-Cpl.) W. E. Robbins (Falmouth).
No. 352312 Pte. W. Robinson (Padiham).
No. 352587 Pte. M. Rowe (Preston).
No. 386257 Pte. E. V. Smith (Newcastle).
No. 74364 Pte. G. V. Snell (Birmingham).
No. 29234 Pte. E. Spencer (Barwell).
No. 43171 Pte. W. E. Strickland (Barnoldswick).
No. 64087 Cpl. (Acting Serjt.) A. Swindall (Doncaster).
No. 2368 Pte. L. Symons (Mile End, E.).
No. 58470 Pte. (Acting Serjt.) C. F. M. Taylor (Mapperley).
No. 73611 Pte. E. Taylor (Newcastle-on-Tyne).
No. 386109 Pte. J. Taylor (Newcastle).
No. 37650 Lance-Cpl. J. W. Taylor (Askington).
No. 388282 Pte. T. L. Taylor (Gateshead-on-Tyne).
No. 410103 Pte. W. H. Tingle (Sheffield).
No. 405424 Pte. W. H. Tradewell (Bolsover).
No. 46510 Serjt. G. B. Trim (Deal).
No. 45389 Pte. (Acting Cpl.) L. O. Walford (Plumstead).
No. 3782 Pte. (Acting Lance-Cpl.) J. R. Wells (Landport).
No. 55005 Pte. W. J. Whittaker (Stafford).
No. 90134 Serjt. A. M. Wilson (Glasgow).
No. 20514 Pte. J. H. Woodward (Leigh).

No. 30345 Pte. A. H. Williams, Royal Welsh Fusiliers (Lampeter).

War Office,
February 27, 1919.

ADDITIONAL MENTIONS IN DISPATCHES.

The ollowing names are added to the List of Officers, Ladies, Non-commissioned Officers and Men recommended for Distinguished and Gallant Services and Devotion to Duty in the dispatch from the Field-Marshal Commanding-in-Chief, the British Armies in France, dated November 7, 1917, which was published in the *London Gazette* dated December 11, 14, 18, 21, 24 and 28, 1917 :—

ROYAL ARMY MEDICAL CORPS.

Temp. Capt. H. D. Field (died of wounds).
Temp. Capt. K. T. Limbery (killed).

CORRIGENDA TO "MENTIONS IN DISPATCHES."

British Armies in France Dispatches.

Under Army Medical Service (page 13483).
Col. (Temp. Surg.-Gen.) C. H. Burtchaell, C.B., C.M.G., M.B.
Under Royal Army Medical Corps (page 13485-; 3486).
Capt. (Acting Lieut.-Col.) C. S. Brebner, M.D.
No. 47040 Staff Serjt. D. Moffatt.

War Office,
March 4, 1918.

His Majesty the King has been pleased to confer the undermentioned rewards for Gallantry and Distinguished Service in the Field. The acts of gallantry for which the decorations have been awarded will be announced in the *London Gazette* as early as practicable:—

AWARDED A BAR TO THE MILITARY CROSS.

Temp. Capt. George Lestock Thornton, Royal Army Medical Corps. (M.C. gazetted January 1, 1918.)

AWARDED THE MILITARY CROSS.

Temp. Capt. Robert Daniels Bell, Royal Army Medical Corps.

Amendments.

The following are the correct descriptions of the Officer and Non-Commissioned Officer upon whom rewards have recently been conferred:

Capt. John Elvin Rusby, M.C., Royal Army Medical Corps, Special Reserve. (M.C. gazetted September 26, 1917.)

No. 17933 S. M. David Edward Dean, M.C., Royal Army Medical Corps. (M.C. gazetted January 1, 1918.)

His Majesty the King has been pleased to award the Distinguished Conduct Medal to the undermentioned for Gallantry and Distinguished Service in the Field:—

No. 40508 Serjt. T. Ashmore, M.M., Royal Army Medical Corps (Somerford).

For conspicuous gallantry and devotion to duty in charge of bearers. He led three parties of stretcher-bearers through heavy shell fire to clear R.A.P.'s. He was wounded in the arm while bringing in a wounded man, and later on gassed, but continued to perform his duties until ordered to withdraw.

No. 401452 Serjt. F. Beevers, M.M., Royal Army Medical Corps (Leeds).

For conspicuous gallantry and devotion to duty. He worked at a regimental aid post during an action, and by his courage and example kept his workers working day and night until all cases were cleared. He passed several times through an intense enemy barrage, and it was largely owing to his determination and initiative that all the wounded were got away.

No. 27821 Serjt. A. Blandford, Royal Army Medical Corps (Newport).

For conspicuous gallantry and devotion to duty during a heavy bombardment of gas and H.E. shells. He led a party of stretcher-bearers to the rescue of some gunners whose dug-outs had been blown in. At great personal risk they succeeded in digging them out and rescued three alive. It was due to his initiative, courage and energy that three lives were saved.

No. 37128 Cpl. (Acting Serjt.) A. C. Cardy, M.M., Royal Army Medical Corps (Bridlington).

For conspicuous gallantry and devotion to duty while in charge of forward bearers. He superintended the evacuation of the wounded under continuous heavy fire and over almost impassable ground, remaining at his work until all the wounded were cleared, although wounded himself.

No. 493533 Lance-Serjt. J. Cassingham, Royal Army Medical Service (Gravesend).

For conspicuous gallantry and devotion to duty. He reconnoitred an advanced position under heavy fire, searching for wounded men. He then led forward a bearer party and brought in the wounded, making three journeys, each of which occupied three hours. He set a splendid example of determination and resource.

No. 497305 Staff-Serjt. R. O'Nions, Royal Army Medical Corps (Coulsdon).

For conspicuous gallantry and devotion to duty. He worked with untiring energy for several days, removing the wounded under most difficult conditions. When the remainder of his party were casualties he worked alone for several hours until overcome by gas. It was largely due to his splendid example that the evacuation of the wounded was successfully carried out.

3rd Class Asst.-Surg. R. H. F. Parkinson, I.S.M.D.

For conspicuous gallantry and devotion to duty. Throughout the action he remained in close contact with the fighting troops, and by his cool courage and professional skill the wounded were dressed and evacuated with the utmost dispatch. Though the heat was intense, he performed magnificent work.

No. 1998 Serjt. E. Patrick, M.M., Royal Army Medical Corps (Leeds).

For conspicuous gallantry and devotion to duty in charge of a relay post for three days. He worked without ceasing, collecting and evacuating wounded under heavy shell fire, and so saved the lives of many men.

No. 32509 Pte. (Acting-Serjt.) R. G. Wardrop, M.M., Royal Army Medical Corps (Hartley Wintney).

For conspicuous gallantry and devotion to duty when in charge of a bearer-post. He got all he wounded away from his post under intense shell fire, and in spite of casualties among the

bearers, working in the open in utter disregard of danger. He set a magnificent example of courage and untiring energy.

No. 39168 Staff-Serjt. O. Williams, Royal Army Medical Corps (Pontypridd).

For conspicuous gallantry and devotion to duty when a dug-out at a forward post was blown in during an action. He was the first on the spot assisting to extricate the wounded under very heavy shell fire. When both the officers at the post were wounded he took command, controlling the evacuation of the wounded with great skill. His coolness and disregard of self were a stirring example.

No. 4977 Pte. (Acting Serjt.) W. Wilson, Royal Army Medical Corps (Dundee).

For conspicuous gallantry and devotion to duty. When casualties were caused at a position which was subjected to a heavy bombardment he at once organized a party of bearers, hastened to the spot, and succeeded in rescuing a wounded officer under heavy fire. Later, he rendered most valuable service in helping to rescue two men who had been buried in a dug-out. On many other occasions he displayed courage and coolness of a high order.

War Office,
March 7, 1918.

The following dispatch has been received by the Secretary of State for War from Major-General A. R. Hoskins, C.M.G., D.S.O., late Commanding-in-Chief, East Africa Force:—

General Headquarters,
East Africa Force.
May 30, 1917.

My Lord,—I beg to forward herewith lists of those whom I recommend for mention in dispatches.

I have the honour to be, my Lord,
Your obedient Servant,
A. R. Hoskins, *Major-General.*

Staff.

Major R. T. Brown, D.S.O., M.D., Royal Army Medical Corps.

Medical Services.

Royal Army Medical Corps.

Capt. R. S. Armour, M.B.
Capt. G. B. Fleming, M.B.
Capt. J. D. Kidd, M.B.
Capt. J. J. D. La Touche, M.B., Special Reserve.
Capt. (Acting Major) W. A. MacLennan, M.B., Special Reserve.
Major (Temp. Lieut.-Col.) A. McMunn.
Temp. Major R. T. Meadows, D.S.O., M.D. (late Surgeon-Major Army Medical Reserve of Officers).
Capt. W. Mitchell, M.B.
Capt. B. Varvill.
Temp. Capt. A. M. Webber, F.R.C.S.
No. 50899 Cpl. (Acting Serjt.) F. Bray.
No. 36708 Pte. J. Brockless.
No. 6893 Pte. A. Chubb.
No. 60272 Pte. O. J. Gray (deceased).
No. 36717 Pte. E. Iredale.
No. 36719 Pte. W. Jackson.
No. 1643 Serjt. (Acting Staff-Serjt.) F. H. Mattock.
No. 1375 Serjt. H. Shipton.
No. 36729 Pte. J. Sidebottom.

The following dispatch has been received by the Secretary of State for War from Lieut.-Gen. J. L. Van Deventer, K.C.B., Commanding-in-Chief, East Africa Force:—

General Headquarters,
East Africa Force,
October 11, 1917.

My Lord,—I beg to forward herewith the names of those Officers, Non-commissioned Officers and Men of the Forces under my command whom I wish to bring to your notice for Meritorious Service in the Field.

I have the honour to be, my Lord,
Your most obedient Servant,
J. Van Deventer, *Lieut.-Gen.,*
Commanding-in-Chief, East Africa Force.

Staff Headquarters, &c.

Col. G. D. Hunter (Temp. Surg.-Gen.), C.B., C.M.G., D.S.O., Army Medical Service.
Lieut.-Col. C. J. O'Gorman, D.S.O., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) G. W. Tate, D.S.O., M.B., Royal Army Medical Corps.
No. 63131 Pte. H. Birchall, Royal Army Medical Corps.

ROYAL ARMY MEDICAL CORPS.

Capt. R. P. Cormack, M.B.
Temp. Qmr. and Hon. Lieut. E. J. Harris.
Major H. Hemsted.
Capt. P. E. Lander.
Temp. Capt. D. McIntyre, M.B.
Capt. E. S. Walls, Special Reserve.
Temp. Capt. A. McP. Warner, M.D.
No. 68999 Pte. E. Ainscow.
No. 54514 Pte. P. A. Mudd.
No. 322008 Cpl. (Acting Serjt.) W. Paterson.
No. 4569 Serjt. L. Richardson.

NYASALAND LOCAL FORCES.

Medical Corps.

Capt. A. P. M. Anderson.
Major (Acting Lieut.-Col.) W. Gilbert, M.B., F.R.C.S.
Capt. A. McW. Green.
Capt. (Temp. Major) F. S. Jones.
Capt. (Temp. Major) W. D. Miller, M.B.
Temp. Capt. A. F. H. Rabagliati, M.D.
Lieut.-Col. T. Smythe.
No. 365 Staff-Serjt. T. J. Burke.
No. 836 Pte. A. Chapman.
No. 2012 Staff-Serjt. C. J. Eales.
No. 1269 Pte. (Acting Serjt.) E. F. Earl
No. 1294 Staff-Serjt. W. D. Jackson.
No. 810 Staff-Serjt. A. S. Whittaker.

War Office,
March 12, 1918.

The Secretary of State for War has received the following dispatch, addressed to the Chief of the General Staff, India, by Lieut.-General Sir Stanley Maude, K.C.B., Commanding-in-Chief, Mesopotamian Expeditionary Force:—

General Headquarters,
Mesopotamian Expeditionary Force,
November 2, 1917.

SIR,—With reference to the concluding paragraph of my dispatch dated October 15, 1917, I have the honour to submit herewith a list of names of those Officers, Ladies, Non-Commissioned Officers and Men serving, or who have served, under my command, whose distinguished and gallant services and devotion to duty I consider deserving of special mention.

I have the honour to be, Sir,
Your obedient Servant,
F. S. MAUDE,
Lieut.-General,
Commanding-in-Chief,
Mesopotamian Expeditionary Force.

Col. (Temp. Surg.-Gen.) A. P. Blenkinsop, C.B., Army Medical Service.

ROYAL ARMY MEDICAL CORPS.

Temp. Capt. R. C. Begg, M.B.
Capt. W. H. Biggs (Territorial Force).
Lieut.-Col. J. H. R. Bond, D.S.O.
Capt. T. K. Boney, M.D., Special Reserve.
Capt. A. E. Bonham (Territorial Force).
Temp. Lieut. D. F. Borrie.
Temp. Capt. T. P. Buist, M.B.
Major (Acting-Lieut.-Col.) G. E. Cathcart, M.B.
Capt. J. W. Dalglish, M.B., Special Reserve.
Temp. Major (Temp. Lieut.-Col.) R. Davies-Colley, F.R.C.S.
Temp. Lieut. G. Dougan, M.D.
Capt. W. Dunlop, M.B., Special Reserve.
Lieut. J. Ewing.
Brevet-Col. M. H. G. Fell, C.M.G.
Capt. M. Foster, M.B., Special Reserve.
Lieut.-Col. (Temp. Col.) S. F. St. D. Green, M.B.
Capt. D. R. Hennessy, Special Reserve.
Temp. Qmr. and Hon. Lieut. C. Hunt.
Capt. T. P. Inglis, M.B., Special Reserve.
Capt. C. M. Ingoldby.
Temp. Capt. T. S. Keith, M.B., late Royal West Surrey Regt.
Capt. J. de M. Kneebone, M.B., Special Reserve.
Temp. Lieut. A. C. Lambert, M.D.
Capt. J. W. MacLean, M.B.
Capt. and Brevet-Major W. McNaughton.
Temp. Qmr. and Hon. Lieut. C. E. Malyon.
Temp. Capt. G. S. Marshall.
Capt. J. P. Mitchell, M.D., Special Reserve.
Capt. W. K. Morrison, D.S.O., M.D.
Temp. Capt. V. E. Negus.
Temp. Capt. C. J. B. Pasley.
Temp. Capt. A. Poole, M.B.
Temp. Capt. N. N. Purkis.
Lieut. (Temp. Capt.) H. P. Rudolf, M.B.
Brevet-Lieut.-Col. D. S. Skelton, D.S.O.
Brevet-Col. J. M. Sloan, C.M.G., D.S.O., M.B.
Capt. G. N. Smyth, Special Reserve.
Temp. Capt. R. Y. Stones, M.B., F.R.C.S. Edin.
Temp. Capt. G. S. Terry.
Major (Acting Lieut.-Col.) L. F. Whelan, M.B.
Lieut.-Col. W. A. Woodside, D.S.O.
No. 75963 Pte. G. Ambler.
No. 34007 Qmr.-Serjt. G. C. Bester.
No. 500060 Lance-Cpl. E. Brooke, 2nd East General Hospital (Territorial Force).
No. 35737 Cpl. J. B. Brown.
No. 464004 Serjt. (Acting Staff-Serjt.) W. E. Dalling, No. 101, Sanitary Section (Territorial Force).
No. 16317 Pte. S. Davenport.
No. 97966 Pte. (Acting Lance-Cpl.) W. Drummond.
No. 328019 Pte. C. Fischbacker, 4th Section General Hospital (Territorial Force).

No. 2686 Lance-Cpl. R. C. Ford, Devon Regt.
No. 27348 Serjt. W. Greenwood.
No. 954 Serjt. H. C. Hallett.
No. 23542 Serjt. A. E. Hughes.
No. 14926 Serjt.-Major W. H. G. Hunt.
No. 4435 Pte. J. G. Hunter.
No. 32621 Pte. (Acting-Serjt.) A. Johnson.
No. 25648 Serjt. H. J. Jones.
No. 24351 Pte. W. P. Kelly.
No. 12002 Staff-Serjt. (Acting Staff-Serjt.-Major) W. J. Knee.
No. 69958 Serjt. (Acting Staff-Serjt.) H. Latter.
No. 545356 Pte. (Acting Cpl.) T. H. Legge.
No. 505021 Staff-Serjt. A. Longstaff.
No. 464006 Cpl. B. M. Luxmore.
No. 17857 Qmr.-Serjt. (Acting Serjt.-Major) A. E. Macklen.
No. 751 Staff-Serjt. (Acting Qmr.-Serjt.) A. J. Milne.
No. 76141 Pte. J. E. Price.
No. 97911 Pte. J. Rudd.
No. 464001 Lance-Cpl. (Acting Lance-Serjt.) S. J. Smith.
No. 24681 Serjt. (Acting Staff-Serjt.) W. Smith.
No. 35559 Pte. (Acting Serjt.) E. G. Tilt.
No. 505004 Pte. (Acting Lance-Cpl.) H. Tunbridge.
No. 70345 Pte. W. H. Wheele.

ARMY MEDICAL SERVICE.

Major-Gen. T. H. J. C. Goodwin, C.M.G., D.S.O., from Deputy Director-General, to be Director-General (Temporary), and to be Temporary Lieutenant-General vice Lieut.-Gen. Sir A. Keogh, G.C.B., M.D., F.R.C.P. (retired pay), dated March 1, 1918.

Col. G. B. Stanistreet, C.M.G., from an Assistant Director-General to be Deputy Director-General (Temporary), and to be Temporary Major-General, dated March 1, 1918.

Col. J. R. McMunn, C.M.G., to be Assistant Director-General (Temporary), vice Col. G. B. Stanistreet, dated March 1, 1918.

The undermentioned notifications will have effect from the dates on which the officers named were promoted substantive or temporary Surgeon-Generals, ranking as Lieutenant-General or Major-General respectively:—

Surg.-Gen. (ranking as Lieut.-Gen.) Sir A. T. Sloggett, K.C.B., K.C.M.G., K.C.V.O., F.R.C.S., K.H.S., to be Lieutenant-General, dated June 1, 1914.

The undermentioned Surgeon-Generals (ranking as Major-Generals), to be Major-Generals, with effect from the date of their appointments as Surgeon-Generals:—

Sir W. Babtie, V.C., K.C.M.G., C.B., M.B. K.H.S.
L. E. Anderson, C.B.
H. G. Hathaway, C.B.
W. G. A. Bedford, C.B., C.M.G., M.B.
M. W. O'Keeffe, C.B., M.D.
W. G. Birrell, M.B.
F. J. Jencken, C.B., M.B.
Sir F. H. Treherne, K.C.M.G., F.R.C.S.Edin.
W. W. Pike, C.M.G., D.S.O., F.R.C.S.I.
H. N. Thompson, C.B., C.M.G., D.S.O., M.B.
W. T. Swan, C.B., M.B.
G. Cree, C.B., C.M.G.
H. Carr, C.B., M.D.
A. A. Sutton, C.B., D.S.O.
M. T. Yarr, K.C.M.G., C.B., F.R.C.S.I.
C. H. Burtchaell, C.B., C.M.G., M.B.
T. H. J. C. Goodwin, C.M.G., D.S.O.
J. J. Gerrard, C.B., M.B.
F. R. Newland, C.M.G., M.B.
J. J. Russell, C.B., M.B.

The undermentioned Colonels (Temporary Surgeon-Generals) to be Temporary Major-Generals, with effect from the date of their appointments as Temporary Surgeon-Generals:—

O. R. A. Julian, C.B., C.M.G.
M. P. C. Holt, K.C.M.G., C.B., D.S.O.
A. P. Blenkinsop, C.B., C.M.G.

The undermentioned Temporary Surgeon-Generals to be Temporary Major-Generals whilst employed as Surgeon-Generals, with effect from the date of their appointments as Temporary Surgeon-Generals:—

Sir G. H. Makins, G.C.M.G., C.B., F.R.C.S.
Sir A. A. Bowlby, K.C.M.G., K.C.V.O., F.R.C.S.
C. S. Wallace, C.M.G., F.R.C.S.
Sir B. Moynihan, Kt., C.B., M.B., F.R.C.S.

The undermentioned Temporary Surgeon-Generals to be Temporary Major-Generals whilst employed as Physician-Generals, with effect from the date of their appointments as Temporary Surgeon-Generals:—

Sir W. P. Herringham, Kt., C.B., M.D.
Sir J. R. Bradford, K.C.M.G., C.B., M.D.
Sir B. E. Dawson, G.C.V.O., C.B., M.D.

Surg.-Gen. (ranking as Lieut.-Gen.) Sir A. Keogh, G.C.B., M.D., F.R.C.P., retired pay, Acting Director-General, Army Medical Service, to be Lieutenant-General on the retired list, dated January 1, 1905.

Surg.-Gen. (temporarily ranking as Lieut.-Gen.) T. J. O'Donnell, C.B., D.S.O., retired pay, to be Major-General on the retired list, February 18, 1915, and to be Temporary Lieutenant-General whilst employed as Director of Medical Services in India, dated September 21, 1916.

Surg.-Gen. Sir W. Donovan, K.C.B., retired pay, a Director of Medical Services, to be Major-General on the retired list, dated December 2, 1904.

Surg.-Gen. Sir W. G. Macpherson, K.C.M.G., C.B., M.B., retired pay, a Deputy Director-General, Medical Services, to be Major-General on the retired list, dated July 14, 1914.

Col. (Hon. and Temp. Surg.-Gen.) Sir J. M. Irwin, K.C.M.G., C.B., M.B., retired pay, to be Temporary Major-General whilst employed as a Director of Medical Services, dated April 1, 1916.

Col. (Hon. and Temp. Surg.-Gen.) B. M. Skinner, C.M.G., M.V.O., retired pay, to be Temporary Major-General whilst employed as a Director of Medical Services, dated November 1, 1916.

Col. (Hon. and Temp. Surg.-Gen.) S. Hickson, C.B., M.B., retired pay, to be Temporary Major-General whilst specially employed.

Lieut.-Col. D. D. Shanahan, D.S.O., from Royal Army Medical Corps, to be Colonel, dated December 26, 1917.

Col. Edward George Browne, C.B., to be Temporary Surgeon-General, dated Febeuary 21, 1918.

The undermentioned relinquish the temporary rank of Colonel on re-posting:—

Dated December 10, 1917.—Lieut.-Col. Francis J. Brakenridge, C.M.G.

Dated January 16, 1918.—Brevet-Col. Frederick Smith, C.B., C.M.G., D.S.O.

Lieut.-Col. Frederick S. Penny, C.M.G., M.B., to be Temporary Colonel whilst employed as Assistant Director of Medical Services of a Division, dated December 11, 1917.

Capt. V. C. Honeybourne to be Temporary Major whilst in command of a Field Ambulance, dated December 13, 1915. (Substituted for the notification in the *Gazette* of April 18, 1916.)

The undermentioned Lieutenants (Temporary Captains) to be Captains:—

Dated February 28, 1918.—John C. A. Dowse, M.C., M.B.; Cedric O. Shackleton, M.B.; Frank P. Freeman, M.C.

Major Sir E. Worthington, Knt., C.M.G., M.V.O., Royal Army Medical Corps, from a Deputy Assistant Director-General, to be an Assistant Director-General, and to be Temporary Lieutenant-Colonel, dated March 1, 1918.

Major P. G. Easton, D.S.O., Royal Army Medical Corps, to be a Deputy Assistant Director-General, *vice* Major Sir E. Worthington, C.M.G., dated March 1, 1918.

Major A. B. Smallman, D.S.O., Royal Army Medical Corps, to be a Deputy Assistant Director-General, *vice* Major G. A. D. Harvey, who has vacated, dated March 1, 1918.

Capt. Alan C. Vidal, D.S.O., Royal Army Medical Corps, to be Major, dated February 28, 1918.

Major Frederick E. Rowan-Robinson, M.B., relinquishes the acting rank of Lieutenant-Colonel on re-posting, dating December 27, 1917.

The undermentioned Captains to be Acting Lieutenant-Colonels whilst in command of a Medical Unit:—

Dated December 16, 1917.—Robert B. Price, M.B.

Dated January 10, 1918.—Ivor R. Hudleston.

The undermentioned Captains to be Temporary Majors whilst in command of Field Ambulances:—

Dated August 16, 1915.—Gerald H. Stevenson, M.B.; Percy S. Tomlinson; Benjamin Johnson, M.B. (Substituted for the notification in the *Gazette* of October 13, 1916.)

PROCEEDINGS OF THE ROYAL ARMY MEDICAL CORPS' FUND COMMITTEE.

PARAGRAPH 14 OF THE PROCEEDINGS OF COMMITTEE, ROYAL ARMY MEDICAL CORPS' FUND, HELD AT ADASTRAL HOUSE, WAR OFFICE, ON FEBRUARY 27, 1918.

It was brought to notice that no decision had ever been made as to the number of members requisite to form a quorum at meetings of the Committee, and it was decided that in future the minimum number of members present necessary to transact business should be three (3).

NOTICE.

ROYAL ARMY MEDICAL CORPS FUND, REGULAR ARMY.

ROYAL ARMY MEDICAL CORPS OFFICERS' BENEVOLENT SOCIETY, REGULAR ARMY.

THE Annual General Meeting of the Royal Army Medical Corps Fund will be held in the Library of the Royal Army Medical Corps College, Grosvenor Road, S.W., at 2.30 p.m., on Monday, June 10, 1918.

The Director-General will preside.

It is hoped that all subscribers who can spare the time will be present and will freely express their views on any point connected with the Fund.

The Annual General Meeting of the Royal Army Medical Corps Benevolent Society will take place immediately afterwards.

Any Officers desiring information regarding these Funds are requested to communicate with the Secretary beforehand so that there may be no delay in dealing with any questions asked.

E. M. WILSON,
Lieutenant-Colonel,
Secretary.

124, *Victoria Street, S.W.*

Band Account.

Receipts.

1917.		£ s. d.	£ s. d.
September 19.	Balances brought forward..	205 16 6	5 15 1
October 9.	Manager Central Pier Band Performances on Central Pier, September, 1917 ..	40 0 0	
,, 10.	Bank Co., Cash		74 0
November 15.	Bank, Cash		10 0
December 20.	Cash Account, wrongly shown as Cash	0 10 0	
		£246 6 6	£90 4 1

Audited and found correct,

(Signed) J. FAIRBAIRN, *Major, R.A.M.C., President.*
H. N. SEALY, *Captain, R.A.M.C.,* } *Members.*
H. J. C. GIBSON, *Captain, R.A.M.C.* }

Expenditure.

1917.		£ s. d.	£ s. d.
September 28.	Messrs. Hawkes and Son, Music, etc.	12 0 8	
October 4.	Band President, Expenses on proceeding to London		2 0 0
,, 9.	Mr. Bradley, Bandmaster, Band Fees	74 9 0	
,, 10.	Bandmaster and Bandsman, Band Fees		74 9 0
,, 9.	Mr. Bradley, Salary R.A.M.C. Band	10 0 0	
,, 9.	Serjt. Smith, Salary R.A.M.C. Band	1 10 0	
,, 9.	Serjt. Smith, Incidental Expenses as per List ..		1 19 3
November 15.	Mr. Bradley, Salary R.A.M.C. Band	10 0 0	
,, 15.	Serjt. Smith, Salary R.A.M.C. Band	1 10 0	
,, 15.	Self, Cash	10 0 0	
,, 15.	Mr. Bradley, Incidental Expenses as per List ..		2 0 11
December 20.	Mr. Bradley, Salary November and December ..	20 0 0	
,, 20.	Serjt. Smith, Salary November and December ..	3 2 0	
,, 20.	Mr. Bradley, Incidental Expenses as per List ..		4 9 0
	Bank Account, wrongly shown as Cash per Contra-entry		0 10 0
	Balances	103 14 10	4 15 11
		£246 6 6	£90 4 1

BIRTHS.

HUGHES.—On March 6, at Leek Wootton, Warwick, the wife of Lieut.-Col. G. W. G. Hughes, D.S.O., R.A.M.C., of a son.

McCREERY.—On March 15, 1918, at 3, The Esplanade, Dover, the wife of Capt. (local Major) A. T. J. McCreery, M.C., D.A.D.M.S., Embarkation, of a daughter.

EXCHANGES, &c.

The charge for inserting Notices respecting Exchanges in the Royal Army Medical Corps is 5/- *for not more than five lines, which should be forwarded by Cheque or P.O.O., with the notice, to Messrs. G. STREET and CO., Ltd.,* 8, *Serle Street, London, W.C., not later than the* 22*nd of the month.*

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

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25	4	0 3 4	0 1 5	4	10	1	6	4	4	0	11
	8	0 6 0	0 2 9								
	16	0 10 6	0 5 0								
50	4	0 4 6	0 1 10	6	0	2	1	4	10	1	2
	8	0 7 6	0 3 6								
	16	0 13 3	0 5 10								
100	4	0 6 0	0 3 1	7	10	3	11	6	7	2	5
	8	0 10 0	0 4 10								
	16	0 18 6	0 7 6								
200	4	0 9 6	0 4 5	10	10	7	6	9	0	4	10
	8	0 15 0	0 6 7								
	16	1 6 0	0 9 8								

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All Applications for Advertisements to be made to—

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The back outside cover is not available for advertisements.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS," 324, Adastral House, Victoria Embankment, E.C. 4.

Communications have been received from Lieutenant-Colonels G. B. Edwards, W. I. Thompson; Majors A. S. Gordon Bell, Major A. W. Falconer; Captains J. H. M. Frobisher, H. W. Spaight, Miss I. M. Harmer.

The following publications have been received:—

British: Proceedings of the Royal Society of Medicine, Tropical Diseases Bulletin, Public Health, Journal of the Royal United Service Institution, The Journal of Tropical Medicine and Hygiene, The Medical Journal of Australia, The Royal Engineers' Journal, The Practitioner, Journal of the United Service Institution of India, The Medical Press and Circular, Publications of the South African Institution for Medical Research, St. Bartholomew's Hospital Journal, The Hospital, The Indian Medical Gazette, Edinburgh Medical Journal, Guy's Hospital Gazette, The Medical Review, The Army Service Corps Journal, The Indian Journal of Medical Research, Bulletin of Entomological Research.

Foreign: United States Public Health Service, Bulletin de l'Institut Pasteur, Colonies et Marine, Archives Médicales Belges, Bulletin de la Société de Pathologie exotique, Bulletin of the Johns Hopkins Hospital, Office International d'Hygiène Publique, Giornale di Medicine Militare, Norsk Tidsskrift for Militaermedicin, l'Ospedale Maggiore, Le Caducée, The Journal of Infectious Diseases, Zeitschrift für Militärärzte, Herausgegeben vom Sanität Corps.

MANAGER'S NOTICES.

The JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps," 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

It is requested that all Cheques or Postal Orders for Subscriptions to the Journal, Corps News, Reprints, etc., be crossed "Holt & Co.," and made payable to the "Hon. Manager, Journal R.A.M.C.," and not to any individual personally.

All communications for the Hon. Manager regarding subscriptions, etc., should be addressed to

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CONTENTS.

ORIGINAL COMMUNICATIONS.

PAGE

Report on the Results of the Bilharzia Mission in Egypt, 1915. By R. T. LEIPER, M.D., D.Sc. 235

The Treatment of 102 Carriers of Entamœba Histolytica with Emetine Bismuth Iodide. By Captain W. WADDELL, M.D.Glas., R.A.M.C., Captain C. BANKS, M.B., B.S.Lond., D.P.H., R.A.M.C. (Bacteriologist), H. WATSON, M.A.Cantab., and W. O. REDMAN KING, B.A.Cantab. (Protozoologists) 261

Fuso-Spirochætal Affections of the Mouth and Pharynx. By Captain W. H. MCKINSTRY, R.A.M.C. 274

Notes on a Series of Cases of Gunshot Wounds during the Campaign in East Africa. By Major E. L. FYFFE, R.A.M.C., and Lieutenant C. E. L. BURMAN, R.A.M.C. 296

Remarks on the Treatment of Infected, Especially War, Wounds. By RUTHERFORD MORISON 306

A Study of 109 Cases of Trench Fever, with Special Reference to the Condition of the Heart. By Major T. J. CREAN, V.C., D.S.O., R.A.M.C., and Captain B. H. BARTON, R.A.M.C. 320

A New Test Type for the Detection of Malingerers in the Army. By Captain ALAN W. SICHEL, R.A.M.C. 326

Hernia of the Foramen of Winslow: Operation and Recovery. By Lieutenant H. E. RAWLENCE, R.A.M.C. 332

CLINICAL AND OTHER NOTES.

A System of Erecting Portable Stoves such as are Issued to Medical Units, so as to Form an Efficient and Economical Indoor Cooker. By Lieutenant and Quartermaster R. D. MATTHEWS, R.A.M.C. (T.F.) 338

Intestinal Retractor. By Captain W. S. RICHARDSON, R.A.M.C. . . 341

The Use of the Hay Cooking-stove on Active Service, a Means of Saving Fifty to Eighty per cent of Fuel. By Major L. REYNOLDS, I.M.S. . . . 342

A Simple and Rapid Way of Making an Office Table. By Major L. REYNOLDS, I.M.S. 344

Plan for Building a Pack-store with Minimum Material, Labour and Space. By Major L. REYNOLDS, I.M.S. 345

Improvised Amputation Shield. By Captain VALENTINE H. BLAKE, R.A.M.C. . 347

A Case of "Trench Fever" Contracted in England. By Captain R. D. MACGREGOR, I.M.S.(Retired) 348

REPORT.

Interim Report of the War Office Committee for the Study of Trench Fever . 351

REVIEWS 354